The Electrical Industry's Weekly Magazine

July 1, 1957

Electrical World

A McGraw-Hill Publication

Price 50 Cents

New Dispatch Center Ups Duquesne's Efficiency

... Page 58

Why the Hassle over Fast Tax Writeoff?

... Page 47

E B POWER GS Y
UNIVERSITY MICROFILMS
313 N 1 ST
ANN ARBOR MICH

Paper Worth Many Times Its Weight in Gold
Consumer Appliance Cost vs. Distribution System Expenditures
Visualizing Circuits, Substations, and Their Voltages at Future Load Densities
Outage Performance of 12, 23 and 34.5 KV Primary Distribution Voltages Compared to 4160 V
Projecting Into The Future

NOW IN ITS NINETEENTH YEAR, "Distribution" is published quarterly by General Electric and has a circulation of 22,000 among distribution engineers in electric utilities and consulting engineering firms. Thought-provoking editorials by Editor D. K. Blake, Manager—Power Distribution Engineering, are one reason "Distribution" is preferred reading among utility men and the magazine's circulation continues to grow.

TWELVE YEARS OF PUBLICATION sees "LOAD" of increasing benefit to utility power sales engineers and people in related fields. It presents practical ideas and information to help electrify industry. Editor C. A. Walter (left) discusses a forthcoming issue with R. Cutts, Jr., (right) Mgr.—Electric Utility Industry Sales Development, and F. W. McChesney, Mgr.—Light Manufacturing and Service Industries Sales Development.

Distribution and LOAD:

Why do 32,000 utility men read them?

Rigid criteria are applied to see that each issue of these General Electric magazines provides useful information

The long-time popularity of these magazines can be attributed, in great measure, to these simple questions posed by the editorial staffs before any article is accepted for publication: For "Distribution": Does it help the distribution engineer? And for "LOAD": Does it help the power sales engineer? This is the acid test, and all articles must pass it. Articles for "Distribution" are authored by General Electric engineers. Often these articles are developed in co-operation with utility men. "LOAD" acts as an industry-wide idea exchange medium and clearing house through articles written mostly by utility power sales engineers.

The editorial staffs responsible for these two magazines are men drawn from a wide variety of product, service and engineering experience at General Electric. Each can speak with authority in his field, and each has his fingers on the pulse of contemporary trends and developments. The end results of their efforts, in co-operation with utility and General Electric authors, are two magazines of real service to the electric utility industry.

If you are not yet receiving "Distribution" or "LOAD", and wish to, just write The Editor, Distribution Magazine, or The Editor, LOAD Magazine, General Electric Company, Section 301-360, Schenectady 5, N. Y.

LIVE BETTER ELECTRICALLY

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 148, No. 1 July 1, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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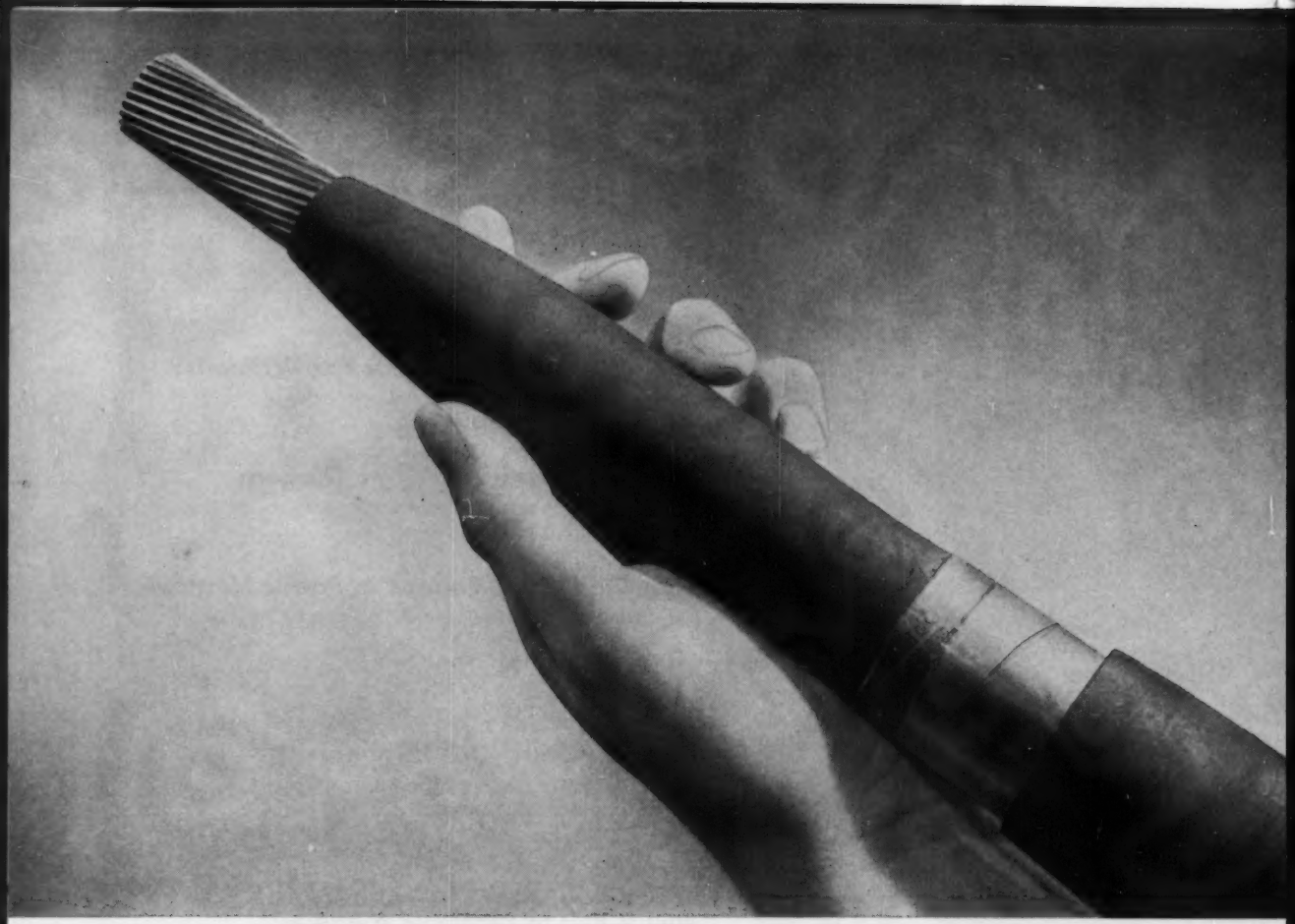

Here's the cable that beats heat, moisture and ozone—KEYSTONE BUTYL

Ready for splicing, this Keystone butyl-insulated cable will soon be fighting the three most common saboteurs of electrical cable.

HEAT. Conductor temperatures of up to 90C don't faze Okonite Keystone butyl-insulated cables. This means (a) given conductor sizes can carry heavier loads, (b) given loads can be carried on smaller cables, (c) cables can work in such hot surroundings as boiler rooms and crowded ducts without fear of failure.

MOISTURE. Keystone butyl-insulated cables leave industry standards far behind . . . retain stable electrical and physical characteristics in the wettest installations. Here's clear proof that these cables may be used with confidence even for direct burial in damp locations.

OZONE AND CORONA CUTTING. Keystone butyl-insulated cables withstand a longer test period and sharper bends than required by the industry for ozone-resistant compounds. In actual operation, these cables have met even higher requirements for superior stability and long life—Okonite's *own* standards.

Write for the Keystone butyl story—complete. Over 12 years of field service and tests, with charts and graphs of test results . . . plus 36 pages of technical data to aid in specifying and installing the right cable for the job . . . have gone into Okonite Bulletin EW-463. Write The Okonite Company, Passaic, N. J.

4811

where there's electrical power . . . there's **OKONITE CABLE**

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. . . *from the publisher*

To Consolidated Edison Co June 18 finally came something it had long expected but which never quite materialized: a summer peak.

In the midst of a heat storm which blast-furnaced the entire eastern half of the U. S., customers pushed Con Edison's peak demand to 3,401,000 kw, a gasping 118,000 kw over the wintertime high.

This event has special meaning at Electrical World for two reasons:

1. To one of the nation's very largest utilities has come a summer peak condition whose importance was greatly discounted by many in the industry only a few years ago.
2. It was just a year ago now that our special department "Heating and Cooling Electrically" made its bow in these pages.

What is the connection between the two?

With Con Edison now in the act, those summer-peak utilities which have long warned the industry that "it can happen to you, too" now have another big booming voice.

To us this means that our "Heating and Cooling" section was well-timed. With a big northerly outfit like Con Ed now in the summer camp, it's a safe bet that more utilities will be taking another look at the situation.

We hope they'll find "Heating and Cooling Electrically" (this week on page 76) helpful in guiding their thinking.

Fischer Black

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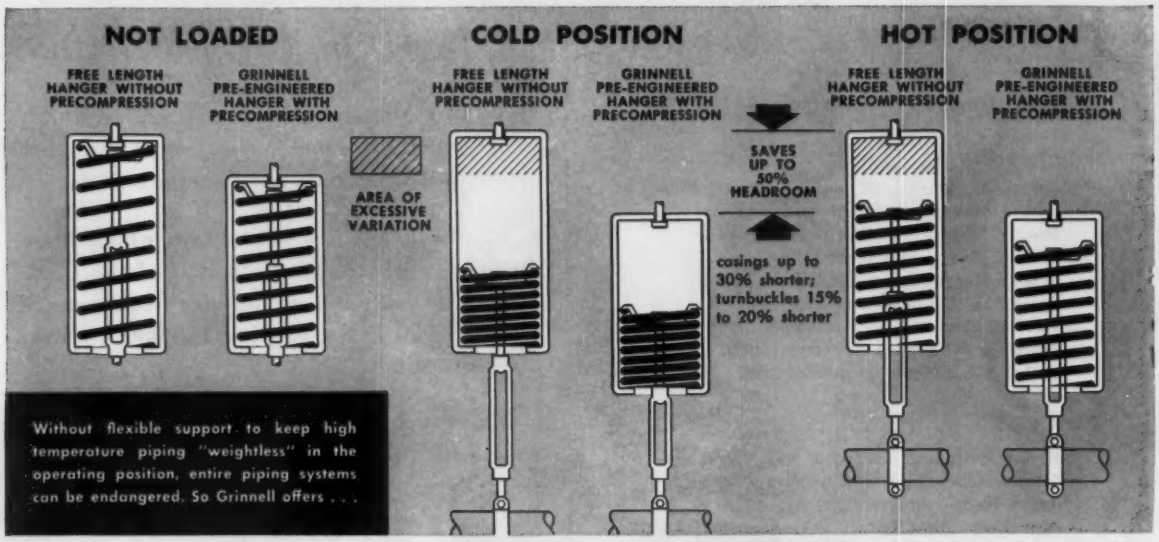

NOT LOADED
COLD POSITION
HOT POSITION
FREE LENGTH HANGER WITHOUT PRECOMPRESSION
GRINNELL PRE-ENGINEERED HANGER WITH PRECOMPRESSION
AREA OF EXCESSIVE VARIATION
SAVES UP TO 50% HEADROOM
casings up to 30% shorter; turnbuckles 15% to 20% shorter
Without flexible support to keep high temperature piping "weightless" in the operating position, entire piping systems can be endangered. So Grinnell offers . . .

Precompressed Hangers for Safer Support of Piping

Helical coil springs are widely used in hangers for flexible support of piping which moves up or down during thermal expansion. The A.S.A. code for pressure piping requires that variable spring hangers support at least a minimum of 75% of the pipe's weight for a pipe that rises (relaxing the spring) and no more than 125% of the pipe's weight for a pipe that lowers (compressing the spring) during operation.

Precompression patented Grinnell principle

To guard against the spring's supporting force exceeding the limits of variation, Grinnell developed and patented a variable spring hanger design. The steel casing holds the spring permanently precompressed, at the threshold of the hanger's working load range. This prevents the spring decompressing into its area of excessive variation.

Pre-set is not a substitute

As a partial substitute for this patented precompression, some manufacturers insert a spacer between the top end of a free-length hanger casing and the spring to hold the spring's height temporarily within the working range during shipment and erection.

Another device requires the manufacturer to drill symmetrically opposite holes in the casing walls and insert a bolt to hold the spring's height within the working range. When these devices are removed from the hanger and discarded, the spring can decompress, resulting in high variability in supporting force.

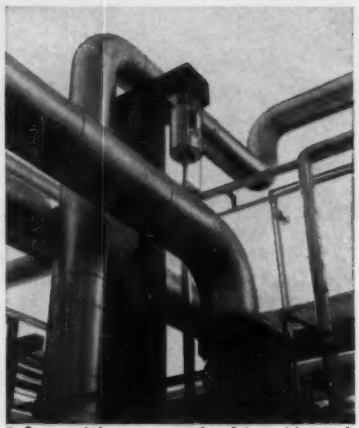
Cold-setting a universal factory service

For the erection crew to avoid having to compress the spring down to the erected position, the manufacturer can compress the spring down to this height. Grinnell can provide a cold-set bolt in precompressed hangers.

Less headroom required by Grinnell Hangers

Shorter hanger casings made possible by Grinnell's patented precompression, reduce bulk shipping weight and required headroom by eliminating undesirable height. Installation is simplified by this shorter casing and also by an integral load scale with load indicator.

Additional headroom is saved by a correspondingly shorter turnbuckle. These precompression advantages are available in short spring and double spring models as well as standard spring models.



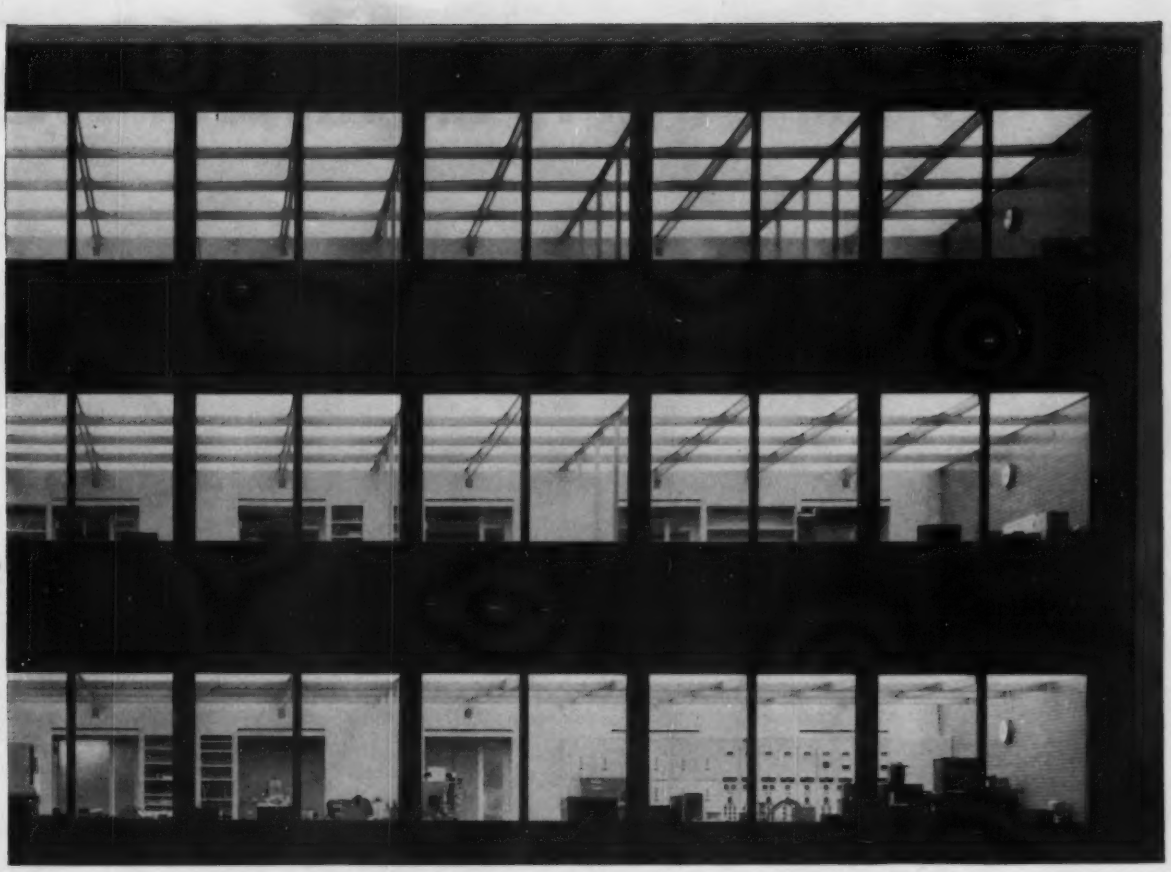
Refinery piping supported safely, with ample flexibility but low headroom.

Available in 63 standard units

Grinnell Variable Spring Hangers are available in 21 sizes each of short, standard and double spring models . . . for maximum travel of 1¼, 2½ and 5 inches respectively within working load ranges. Load capacities extend from 43 lbs to 30,550 lbs. The maximum variation in the standard size per ½-inch deflection is 10½% of rated capacity; inversely proportional in short spring and double spring models.

For further information

If you have a pipe suspension problem, you are invited to write: — Grinnell Company, Inc., 252 West Exchange Street, Providence, R. I.



When you are asked to help out with a customer's lighting problem, you'll find us ready and willing to discuss with you the latest ideas, methods and information available from any one source,—Graybar!

For assistance in the selection of equipment for any lighting system . . .

MERCURY ☐ INCANDESCENT ☐ or FLUORESCENT ☐

. . . call Graybar

Every working day brings you questions from architects, electrical contractors, commercial establishments and industrials concerning the right lighting source and equipment to use for some particular installation. Always remember, you can supplement your own broad knowledge and experience through that of our Lighting Specialists,—men who have contributed to the planning of thousands of installations across the country. Graybar's roots are deep in the lighting industry, and ours is a mutual interest – better lighting, for all.

Next time you have a knotty lighting problem, call your nearby Graybar office. Back up your dealers and contractors with the best of the current ideas selected from up-to-date developments of the nation's leading equipment manufacturers whom Graybar represents. You'll help build your load through the kind of lighting that will contribute to better production schedules in industry, greater sales for your merchant customers, and greater living enjoyment in homes in your area.

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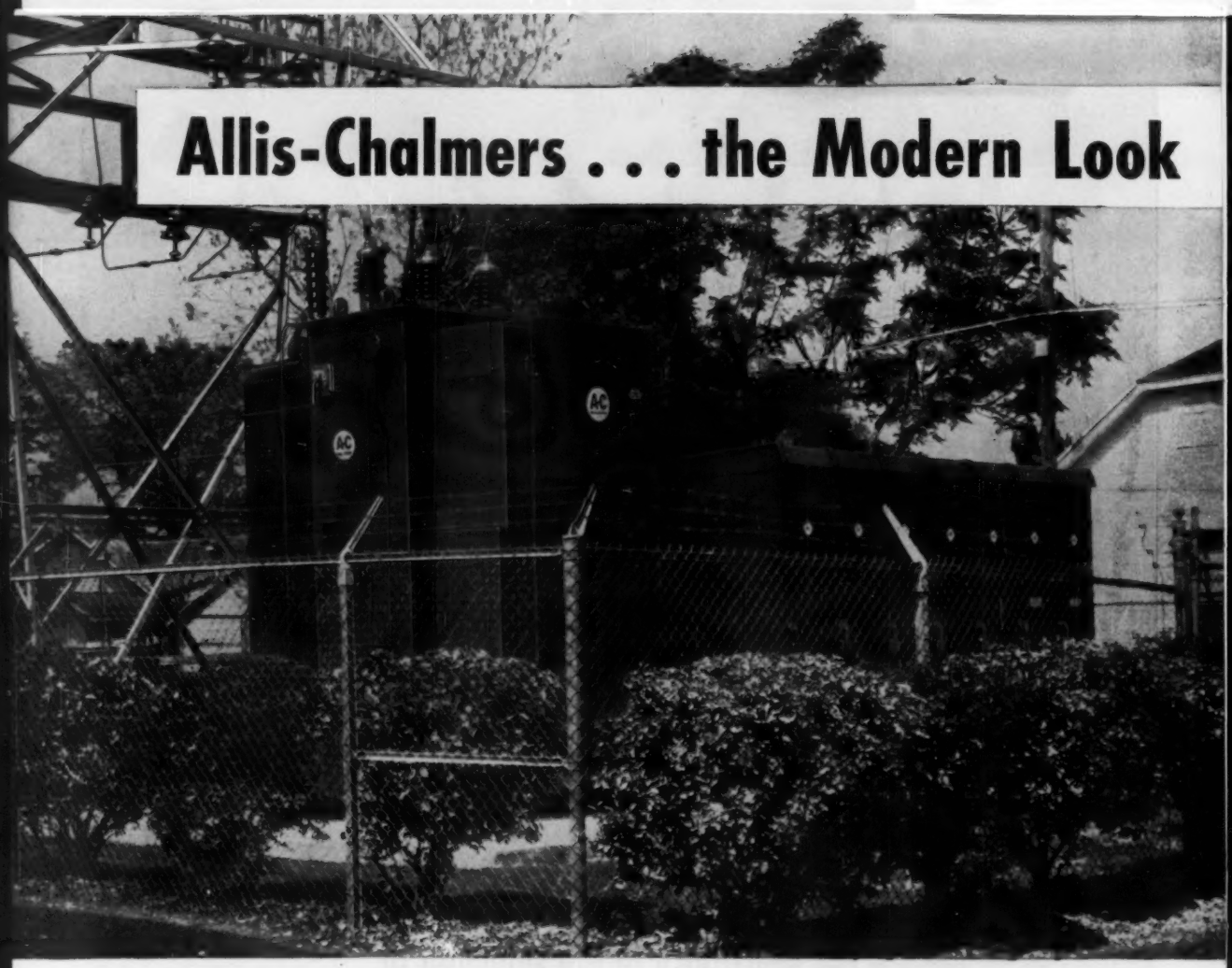


Allis-Chalmers unit-subs offer a 3-way

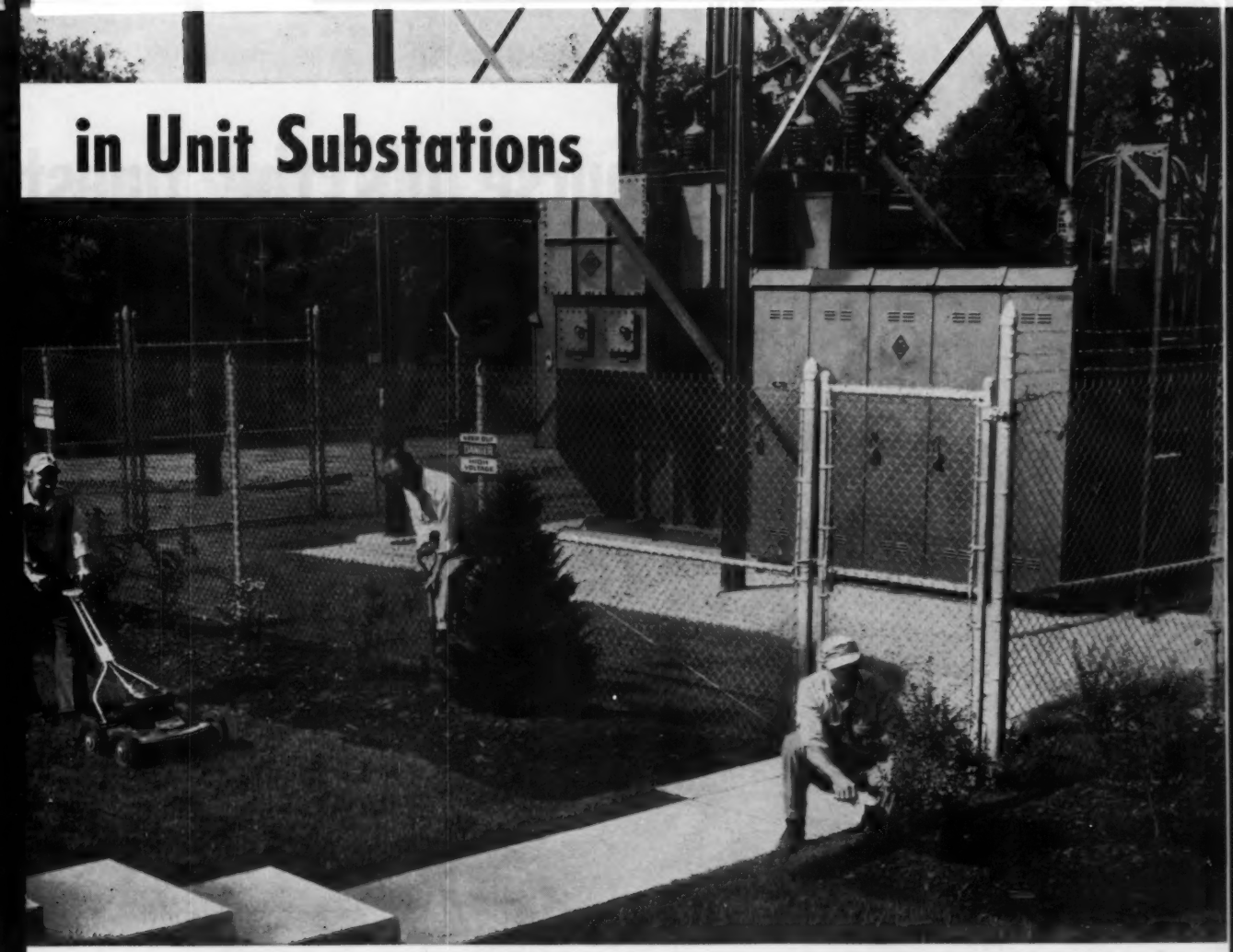
Safety - Convenience

Safety—
Further improve your high safety standards with such features as:

- Mounting of potential and control transformers on drawout carriages for complete isolation of primary and secondary contacts during inspection.
- Automatic, positive-acting shutters to isolate high voltage contacts when breaker is withdrawn . . . *not dependent on springs or gravity.*
- Complete steel barrier compartmentation, flame retardent insulation, and safety interlocks.

Convenience—
Here's a typical convenience extra found in all types of Allis-Chalmers switchgear. You can move breaker to test, or even fully disconnected position inside cubicle . . . *and still close the door.* No special storage space is required for breakers not in use . . . handling is reduced.

ALLIS-



in Unit Substations

answer to your system growth problems

- Versatility

Versatility—

You can build *today* with an eye to the *future* with Allis-Chalmers standardized construction:

- Additional circuits may be added easily due to grouped control wiring . . . dry bus joint . . . jig-built construction.
- Transformers of larger capacity may be substituted without changing throats.
- Current transformers with higher ratios can be substitated. All have same mounting dimensions.
- Major components are interchangeable.

In addition, there's ease of installation, and extra reliability built into Allis-Chalmers switchgear. For the answer to your system growth problems, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

CHALMERS

A-C ALLIS-CHALMERS

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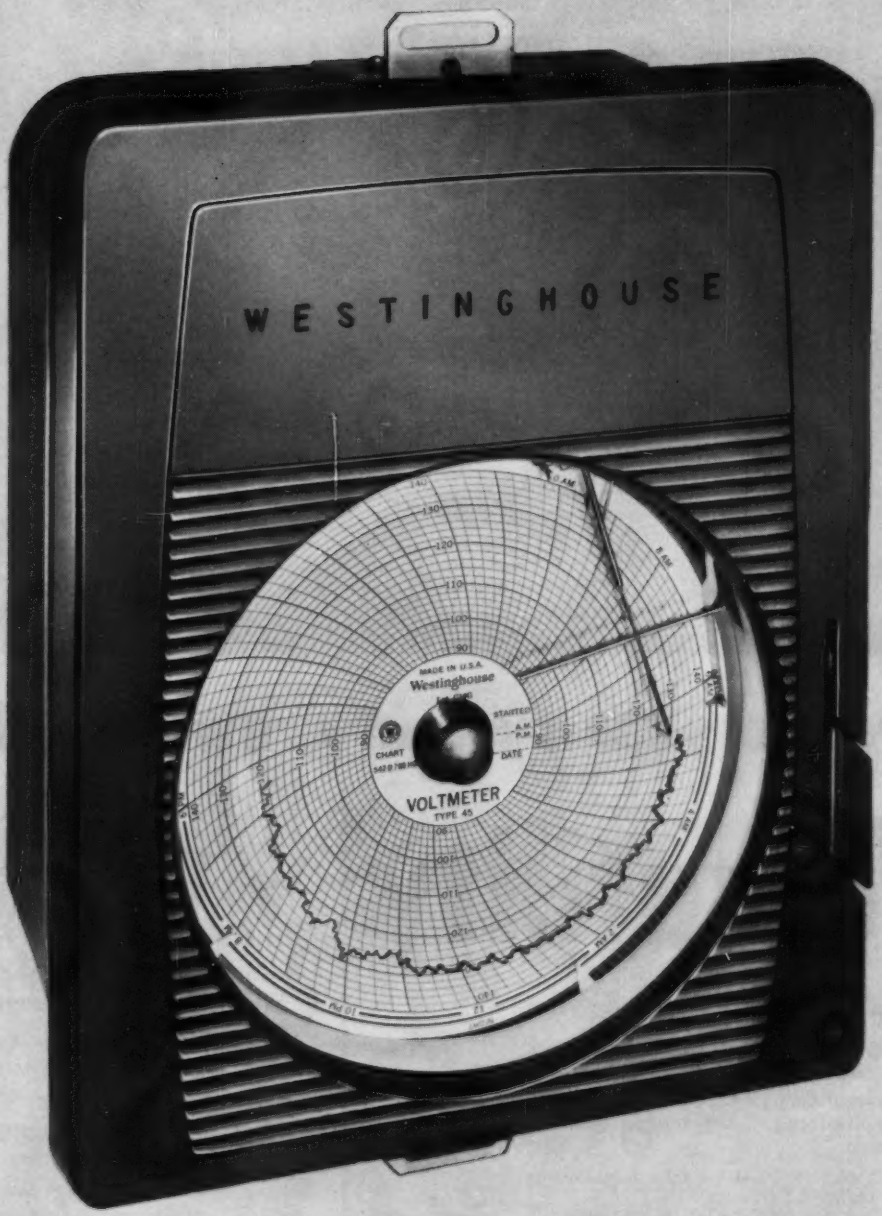
Of course it's the finest.



Type 45 Circular Chart Recorder

. you specified it

We married your ideas to Westinghouse quality

It's new. It's versatile—designed for switchboard mounting or complete portability. It has a unique and exclusive sealed inking system. We can't cover all the special features in the space here.

But the features are the ones *you* wanted—specified when we asked questions of hundreds of engineers and operating men in a predesign survey.

Type 45 is rated at 2% accuracy—but can readily be supplied and guaranteed at 1%. It is weatherproof—neoprene-gasket-sealed—fabricated from corrosion-resistant aluminum alloy. Sapphire bearings are spring mounted to absorb shock. Terminals are in an enclosed housing.

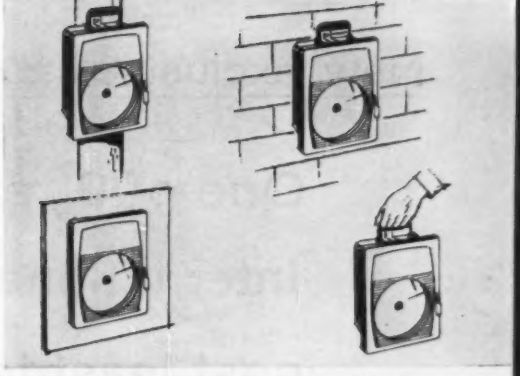
And you get the plus benefit of circular chart recording—more information on less paper, convenient to store and file—less operating cost.

It surely is *your* instrument. You can get all the details—and see a sample—by calling your Westinghouse sales representative. Or you can write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa., requesting booklet B-7212 and catalog section 43-450.

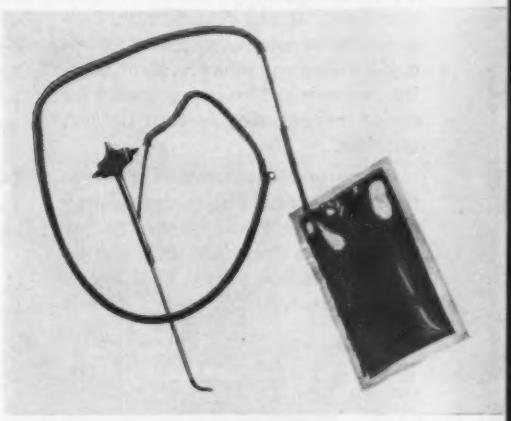
J-40496

YOU CAN BE SURE...IF IT'S

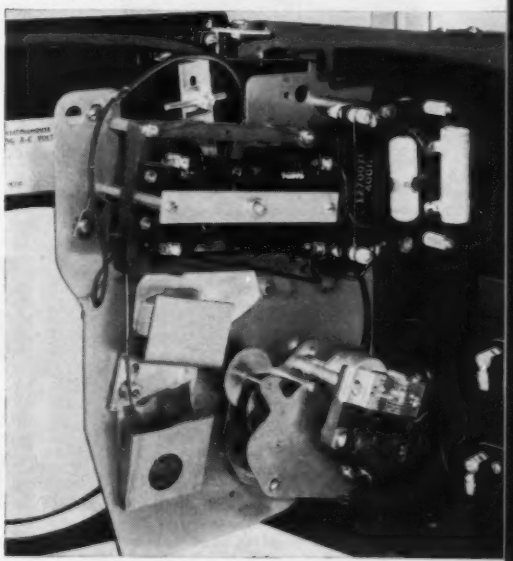
Westinghouse



CONVENIENT—Suitable for flush or projection mounting on a switchboard. Styling coordinated to match other Westinghouse instruments. Portable, too. Adjustable brackets for pole or wall mounting. Clocks either synchronous or 8-day hand-wound. Interchangeable gears for one- or seven-day chart speed. Three-day gears available.



SEALED INKING SYSTEM—Unique for direct-acting electrical instruments. No inkwell. The ink is in a plastic sac, with a plastic tube to the pen. Ink supply lasts a year. No coagulation or evaporation. Pen is Inconel, stainless and corrosion-proof. Tip is platinum-iridium to assure sharp, continuous record.



EASILY SERVICED—You can change charts with your gloves on. Zero adjustment is accessible from open front cover. Built-in pen lifter saves fumbling, misalignment—automatically resets when cover is closed. Entire movement mounted on hinged panel. Just disconnect terminals and lift out. Recorder does not have to be level to operate perfectly.

New, exclusive cab-forward design

One of 9 reasons why you'll find International Trucks cost least to own!

Compact, new cab-forward INTERNATIONAL Trucks feature *low*, full-size cabs for convenient access to save drivers time and effort... short turning radius with bumper clearance for easier maneuvering even in tightest quarters.

These new INTERNATIONALS have more powerful engines in every model—more *usable* power at low rpm to keep operation and maintenance costs low. They haul bigger legal loads with improved weight distribution, with less over-all length.

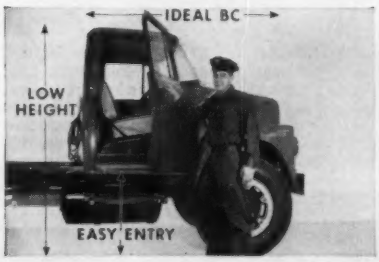
As you would expect, new cab-forward INTERNATIONALS are quality-built from the rugged bumpers to the end of the sturdy frames... built to do a truck job better, longer, for less.

And INTERNATIONAL Trucks cost *least* to own—cost records prove* this. Let your INTERNATIONAL Dealer show you today.

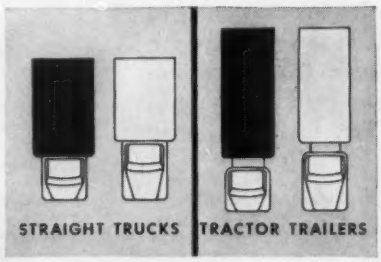
**Signed statements in our files, from fleet operators throughout the U.S., back up this statement.*

INTERNATIONAL HARVESTER COMPANY, CHICAGO

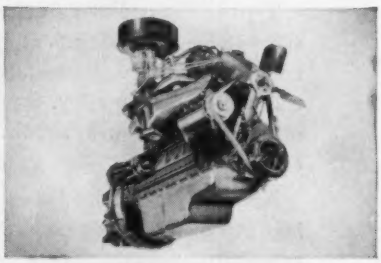
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors



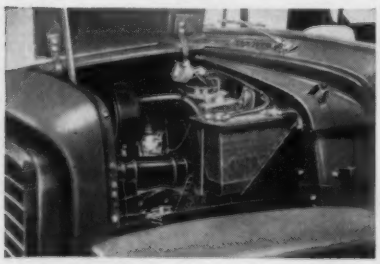
1 Longer legal payloads with ideal 89-inch bumper-to-back-of-cab dimension. Full size, unobstructed cab has 61-inch full-width seats, no wheelhousings. Only 3¼ inches higher than conventional models. Easier, more convenient entry and exit.



2 Bigger payloads with better weight distribution. More load space than conventional trucks with same over-all length—or the same load space with shorter over-all length. Easier to drive and maneuver. Safer, too, with better all-around vision.

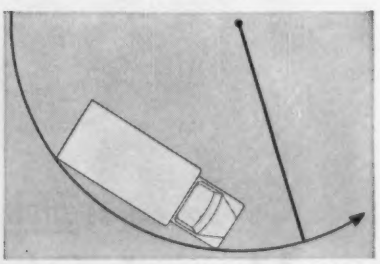


3 Lively, low cost performance with INTERNATIONAL-built engines that produce more *usable* horsepower at low rpm. Higher compression ratios for greater efficiency and economy. 12-volt ignition with "hot spark" circuit. Engines for every job.



4 Superior engine accessibility saves time and money. Large side opening hood permits complete freedom to all engine compartment components. Master cylinder, battery and most frequently serviced units are conveniently located.

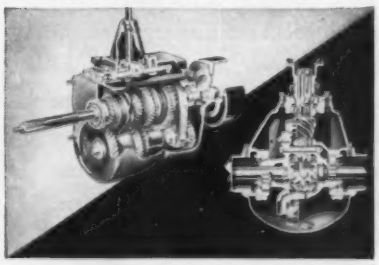
5 Low first cost. New INTERNATIONAL cab-forward models are priced right down with the lowest. They are quality-built throughout to keep operating and upkeep expense at rock bottom. Result: they are built to cost *least* to own over the years.



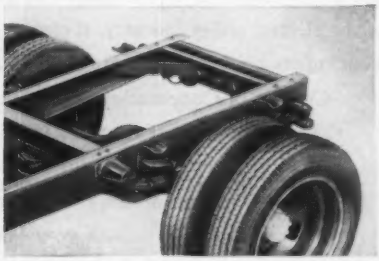
6 Minimum front overhang and true geometric steering for short turning radius with bumper clearance. Cam and roller-mounted twin lever gears are mounted ahead of the front axle. Comfortably positioned four-spoke, safety steering wheel.

This is the new INTERNATIONAL cab-forward design . . . Golden Anniversary models with short 89-inch bumper-to-back-of-cab dimension . . . trucks that are low in height, low in price. All have more powerful six-cylinder engines.

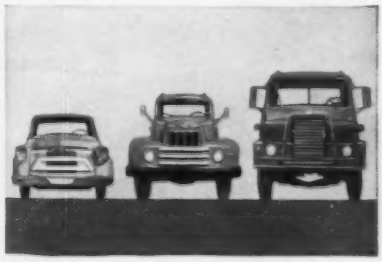
Four-and six-wheel models from 9,000 to 33,000 lbs. GVW are available with the widest selection of components and equipment to match every hauling job requirement exactly . . . built to cost *least* to own over the years.



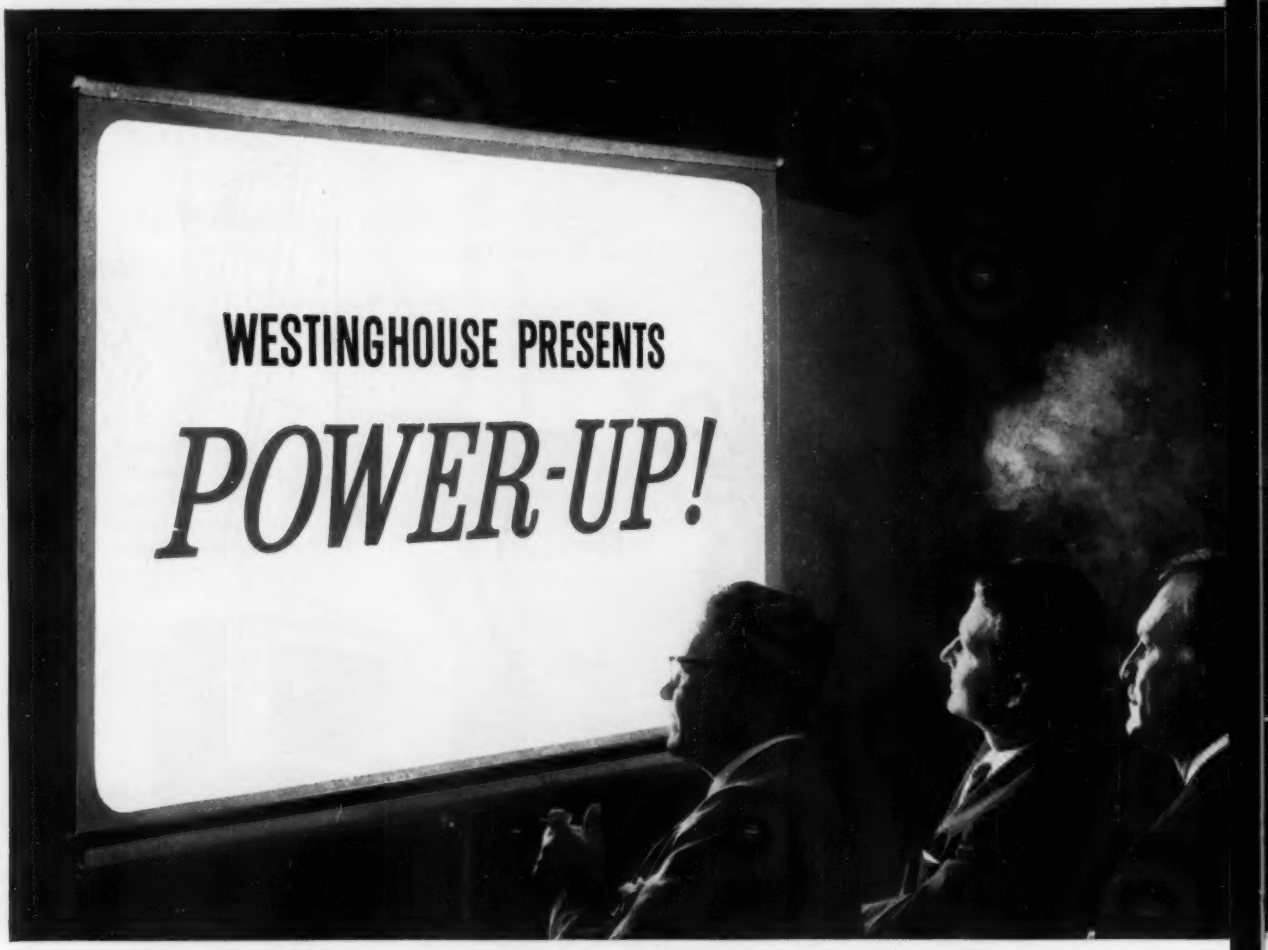
7 Choice of transmissions and rear axles assures you the proper capacity and final drive ratios to match the engine power, your load and road conditions *exactly*. You save on fuel. You get superior on-the-job performance and extended truck life.



8 Steel-Flex frames combine great strength without excess weight. Non-crystallizing cold squeezed rivets are used throughout for extra rigidity and proper flexibility. Factory-built drop-frame models are available to reduce loading time and effort.



9 World's most complete line. There is an INTERNATIONAL "tailor-made" for every job, half-tonners to 96,000 pounders. Choice of 4-wheel, 6-wheel and all-wheel-drive models, conventional and COE design. Every one built to cost *least* to own.



a program of electrical service that helps your

Here's a new program of industrial service based on making future power-production estimates a reality through inter-industry cooperation. Westinghouse offers the utility industry sales aids to stimulate greater industrial electrification — sales engineers to advise on the most efficient use of electrical apparatus. To tie in more closely with the selling aims of the electric utility industry, there are special packaged meetings to show industrial customers how to make better use of electrical power. The Westinghouse Catalog of Cooperation spells out the need for this cooperation. The Handbook of Cooperation lists all the special sales aids such as technical literature and meetings that power salesmen can obtain from Westinghouse to show their customers.

Ask your Westinghouse representative how you can best take advantage of POWER-UP. He will be glad to give you copies of the Handbook of Cooperation, B-7045.

industrial customers increase production...electrically

INDUSTRIAL PLANTS – ASK YOUR LOCAL ELECTRIC UTILITY TO SEE THE FOLLOWING MATERIAL:

There's Profit in Planning Your Power Distribution System

Modern Illumination Techniques

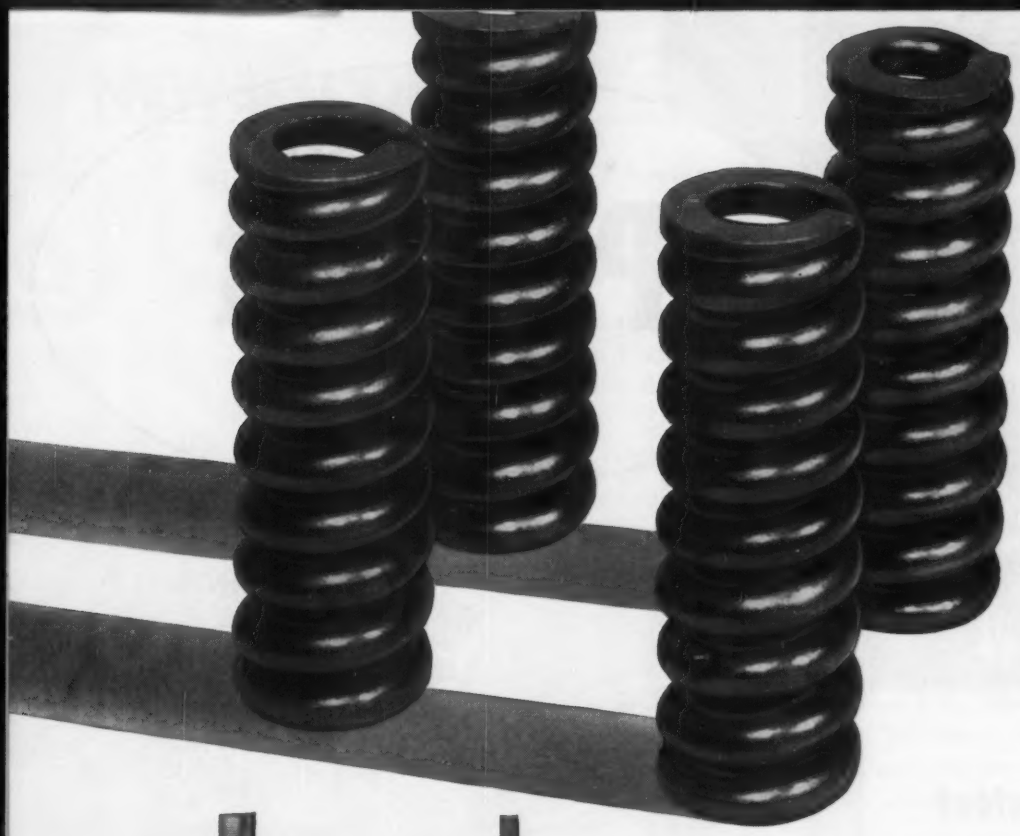
Electric Heat — Production's New Dimension

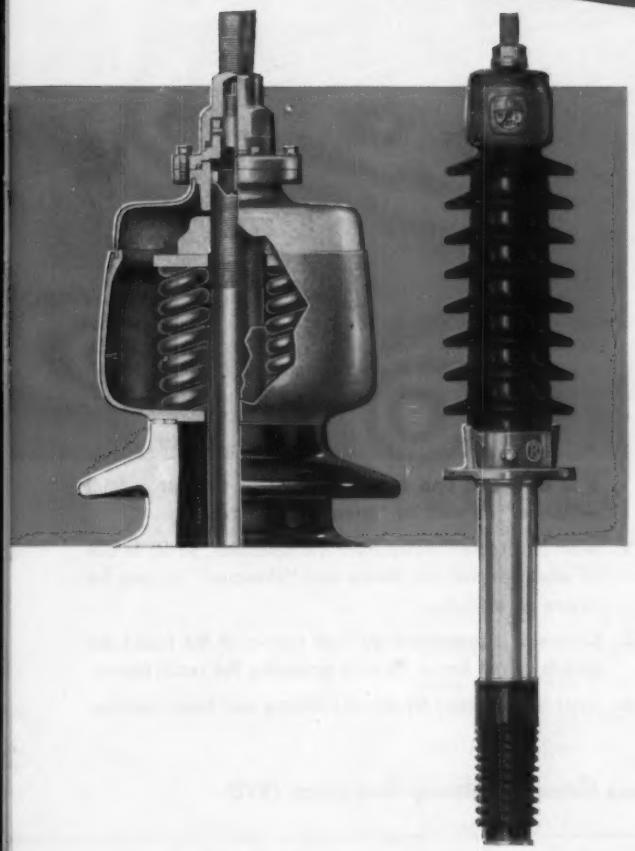
Conditioned Air — Versatile Tool for Profit

J-97207

YOU CAN BE SURE... IF IT'S Westinghouse

WHY O-B BUSHINGS STAY TIGHT!





There was room for improvement in bushing assembly—improvement on the spring compression principal O-B originally developed. Springs must be steel. This meant danger of magnetic heating in the strong field of a bushing conductor if a single spring surrounded that conductor, as was often the case.

Now, in the new O-B condenser bushing, a nest of springs do the work. All are external to the conductor. There's more safety in numbers, and heating is negligible.

To be sure the springs "stay out of the act" in carrying current, the lower portion of the reservoir where the springs seat is insulated from the central conductor. Thus, another possible cause of trouble has been eliminated.

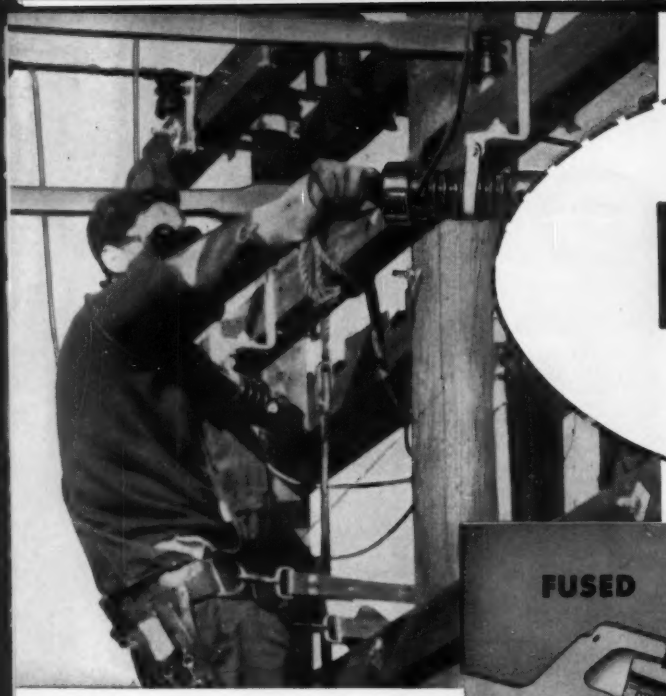
Such design refinements are typical of the new O-B condenser bushing line. After making bushings for 50 years, we knew where sound refinements were needed.

When you specify O-B bushings for your new apparatus you will be getting the cleanest piece of modern design on the market today. It will pay off in better service.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

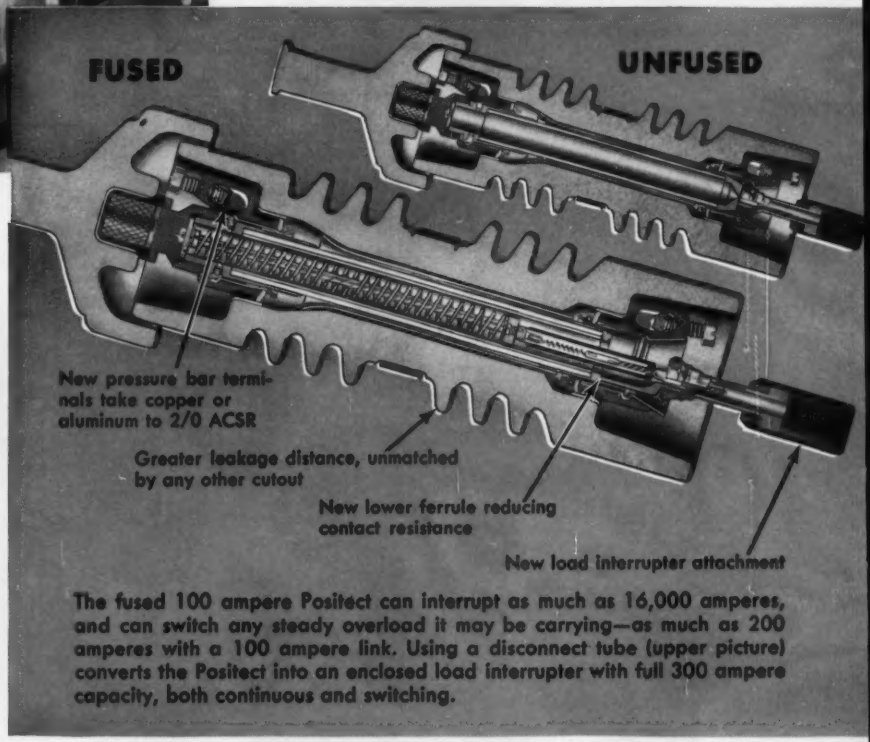
4792-H



. . . a new S&C

Positect

CUTOUT


FUSED
UNFUSED
New pressure bar terminals take copper or aluminum to 2/0 ACSR
Greater leakage distance, unmatched by any other cutout
New lower ferrule reducing contact resistance
New load interrupter attachment

The fused 100 ampere Positect can interrupt as much as 16,000 amperes, and can switch any steady overload it may be carrying—as much as 200 amperes with a 100 ampere link. Using a disconnect tube (upper picture) converts the Positect into an enclosed load interrupter with full 300 ampere capacity, both continuous and switching.

the only enclosed cutout for switching . . . now with load interrupting ratings to 300 amperes unfused . . . 200 amperes fused

By means of a new load interrupter attachment, the S&C Positect now provides full load switching. This new capability is designed to take care of the heavier loads on today's feeders.

The S&C Positect is the only enclosed cutout for load switching. Moreover, its action is positive. There is no external arc—no exposed hot parts. No links are broken.

Load switching capability is not the only "plus" for the Positect. For short circuit protection it's tops, too, besides having unique safety features for the lineman:

1. It is designed and tested for closing against a fault —"make" as well as "break."
2. Blast is directed away from the operator, so he is out of reach of the arc, flame and "shrapnel" in case he closes on a fault.
3. Kickback is prevented by high inertia of the fuse tube as it is driven home, directly opposing the recoil forces.
4. Blast is minimized by arc shortening and freer venting.

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶ **Push is on for TVA revenue bond financing bill this year.** TVA backers are willing to make some compromises, but they'd rather Congress keep control over bond issues than to shift the authority to the Budget Bureau or Treasury.

Even if the federal Hells Canyon bill should slip past the House, it's sure to run into Presidential veto. That's the way Washington observers size up the situation now. And public power men see it the same way.

Good bet for AIEE's 1958-59 president is incoming treasurer, L. F. Hickernell, chief engineer of Anaconda Wire & Cable. He's just been endorsed by AIEE's Technical Operations Department.

Direct bore temperature measurement by means of thermisters will help refine safe procedures for pre-warming large 3600 rpm generator rotors.

LATE NEWS ▶ **In quick unexpected move, Vermont's Gov J. B. Johnson inks pact** for transmission of St. Lawrence power by newly formed Vermont Electric Power Co. The 25-year pact clears the way for constructing a transmission grid to handle the state's allotted 100,000 kw.

New policy proposed for AIEE by outgoing Pres M. S. Coover would transform AIEE into a scientific and educational society only, says new Pres Walter Barrett. "If adopted, it would have its major effect on activities of Engineers Joint Council," he told EW . . . Main goal during his term, says Barrett, will be "to make the new organization structure function. This year department boards will do some things the board of directors has been doing. This should reduce the number and length of board meetings."

Serious fight is shaping up on reappointment of FPC Chairman Jerome Kuykendall, whose term expired June 21. Kuykendall was assailed in long list of charges by public power advocates at Senate Interstate-Foreign Commerce Committee hearing.

The risks involved in atomic installations "are insurable," asserts British Insurance (Atomic Energy) Committee. It proposes new system calling for coverage of industrial atomic power plants throughout the world by a pooling system of British insurance firms.

Power cost of Florida Nuclear Power Group's proposed 136 Mw atomic power plant is expected to fall between 8.3 and 11.2 mills per kwhr, says Dr Walter Zinn of General Nuclear Engineering Corp before Joint Committee on Atomic Energy. FNPG is planning a natural uranium, gas-cooled nuclear reactor under AEC's third round invitation.

Congratulations . . . Potomac Edison's new president is D. E. Stultz, who rises from executive VP post. He succeeds retiring R. Paul Smith . . . At Consolidated Edison, Otto W. Manz, Jr, becomes executive VP and is replaced as VP-sales by C. Wesley Meytrott.

ELECTRICAL WEEK

A TWO-MINUTE

FAST WRITEOFF ▶ **Fast tax amortization, long a provision of federal tax policy,** now becomes effective issue in federal-vs-private power battle. Special four-page news story gives the background, tells some of the reasons behind the current "Hassle Over Fast Tax Writeoffs," **(p 47).**

EVENTS ▶ **Former Truman administration officials are nominated** for top posts on AEC **(p 40)** . . . Court rules that Federal Power Commission has authority to grant license for Niagara power development **(p 40)** . . . Senate passes federal Hells Canyon bill **(p 41)** . . . Rural distribution co-ops form tri-state generation and transmission co-op in Pacific Northwest **(p 42)** . . . Famous painting and 4th of July symbol, "Spirit of '76" is relighted **(p 44)** . . . Company librarian writes, "Library Must Serve All" **(p 45).**

GENERATION ▶ **The fuel element is one vital key to economic nuclear power.** Right now it is one of the factors limiting progress toward higher temperatures for power reactors. The design and fabrication of these elements also affect the burnup, the effectiveness of the chain reaction, and the effective life of the reactor core. For staff report on what's being done and what still needs to be done turn to **(p 55).**

TRANSMISSION ▶ **It required considerable research and special techniques** to get an extra 35-Mva of capacity from a 190-Mva-rated pipe cable, but Public Service E&G is sure it was worth it. J. A. Pulsford, Public Service's distribution plant engineer, tells how nylon tape is used to retain a triangular formation of the conductor in the pipe and how special sand having high thermal conductivity was used for fill to obtain the capacity bonus. He takes you, step-by-step, toward the solution of a problem which other utilities are sure to face **(p 60).**

COMMUNICATION ▶ **Duquesne Light's new system dispatch center is paying off** through increased efficiency of equipment and personnel. Four months of operation also point up the intangible benefits derived from improved function grouping. Duquesne's concentrated service area made the system a natural for central dispatch. The center provides three functional groupings—the system map, the load totalizing board, and the supervisory control board. All are arranged in a room within visual range of the shift supervisor's desk. W. C. Bryson, general superintendent, system operations and load dispatching department, describes the center in words and photographs **(p 58).**

SUBSTATIONS ▶ **Seattle Department of Lighting decides in favor of 39,000-kvar banks of switched capacitors on 115-kv buses** at its Bothell bulk power and switching station. Initially, two banks will supply reactive requirements of transmission and subtransmission lines and transformers serving the northern half of its system. Installation at 115-kv resulted from studies which indicated installed-cost savings of about $0.45 per kvar over installed cost at 26 kv **(p 66).**

PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

INDUSTRIAL ▶ **A 2,300-v radial distribution system won over four other systems** for serving an existing tank field. Purpose of a study made by Author J. A. McLellan, Chemical Construction Corp, was to establish a distribution system whose reliability would match the associated process requirements, and to adapt simultaneously the field to more recent concepts in field pumping requirements. McLellan presents tables and text to show the relative merits of the five different approaches and offers cogent argument for choosing radial system **(p 51)**.

SELLING ▶ **Boosts for street** lighting: Dayton P&L has designed continuous strand of fluorescent down middle of a street for a test strip. First of its kind in the country, the strand provides uniform diffusion of light at pavement . . . "Improvement Districts"—some 160 of them in Montana communities—are helping to step up street lighting. Each district, formed under city council jurisdiction, provides financing for relighting projects and negotiates contracts with the utilities serving the respective areas **(p 74)**.

HEATING & COOLING ▶ **Air conditioning takes another jump.** This time it's used by a drive-in restaurant to pipe cool or warm air into customers' cars. For description of the installation and story of the restaurant which has a connected load of 422 kw, read story **(p 76)** . . . But the gas industry is renewing its efforts to develop a gas-fueled air-conditioning unit for residential and commercial use **(p 76)**.

PEOPLE ▶ **Recently-elected president of Central Utilities Atomic Power Associates** is M. L. Kapp, president of Interstate Power Co . . . At Tucson Gas, Electric Light & Power Co, J. Luther Davis is a new vice president . . . American Institute of Electrical Engineers elects Walter J. Barrett, New Jersey Bell Telephone Co, as 1957-58 president at annual meeting last week **(p 100)**.

NEW EQUIPMENT ▶ **You'll find easier-to-read format on new equipment pages (82, 84, 85, and 86)** . . . Transformer pole bracket will hold three distribution transformers up to 25-kva each and provide plenty of room for climbing and clearance . . . New two-bolt clamp provides more contact surface for aluminum-to-aluminum or aluminum-to-copper conductor in seven sizes from No. 3 to 1,000 Mcm . . . Meter socket clincher is available in improved model for mounting meters on both square and round sockets. It's said to reduce meter breakage **(p 82)**.

MANUFACTURERS ▶ **Price boost of 1.79% on a-c watthour meters** has been announced by Sangamo for orders received after July 1. Instrument transformers go up 10% and d-c metering prices are also being adjusted . . . Okonite dedicates $4.2 million wire and cable plant at North Brunswick, N. J., after closing down its Wilkes-Barre, Pa. plant . . . Transformer protection evaluation program, including demonstration on actual transformer fires, has been started by "Automatic" Sprinkler Corp of America **(pp 96, 98)**.

ENGINEERING TRENDS

Gas turbines offer advantages for serving rapid growth areas. Delivery is quicker; installation time, a fraction of that for steam-turbine plants; water requirements, more easily satisfied in water-scarce areas; and operation and maintenance costs should be low. For these reasons, Sao Paulo's Departmento de Aguas e Energia Eletrica has ordered four 5-Mw units from a U. S. manufacturer to supplement its longer range nuclear and hydro programs.

Tripping off may be preferable to restoring field on a large generator even though most modern units can run safely for two or three minutes above synchronous speed carrying full load as induction generators. First result of the excitation loss is a large displacement of system kvar which can often prove more serious than interrupting the unit's kw contribution.

Ports for observation of boiler combustion may permit direct viewing if experiments with microscopic gold films to prevent sun's heat passing through automobile windshields prove applicable. The thin film turns back heat waves but passes the cooler wave lengths of visual light.

Adequate containment adds less than 5% to the cost of power reactors.

Load measurements on low-voltage networks will be facilitated by the development of a current transformer to fit over the protector bushings, thereby avoiding problems incidental to testing parallel cables. One device designed for this service will withstand submersion and can be used with submersible metering equipment in vaults subject to flooding.

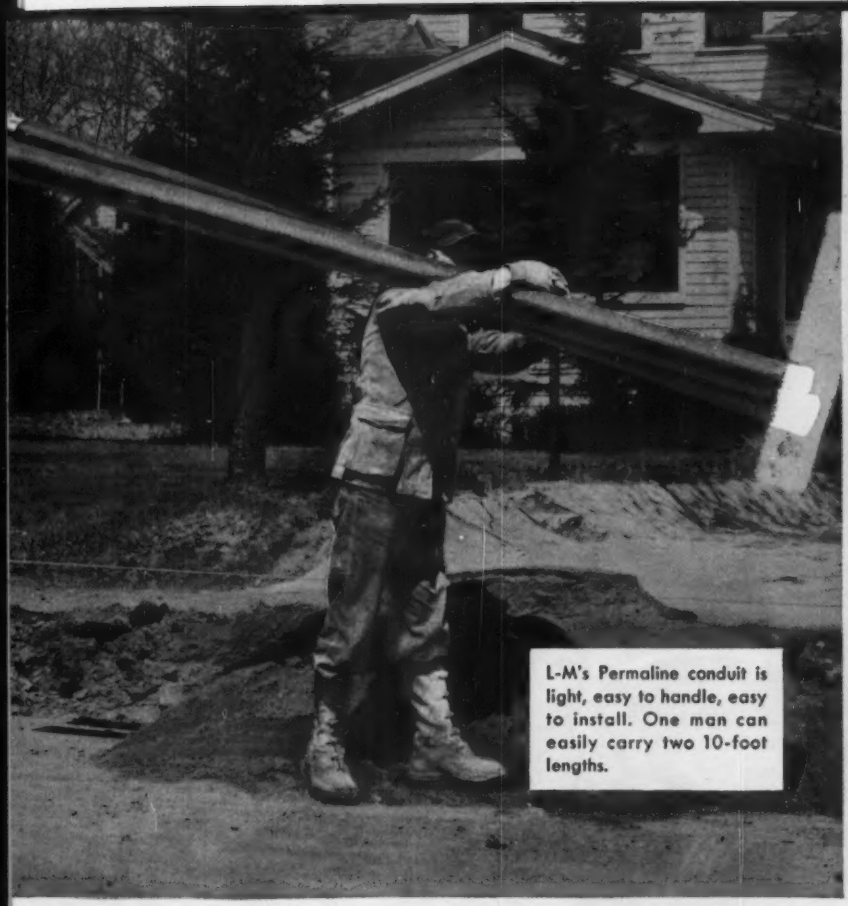
Secondary capacitors in series with distribution transformer primaries are the key to one Eastern utility's plan to load their transformers to 200%.

FROM EDITORS IN THE FIELD

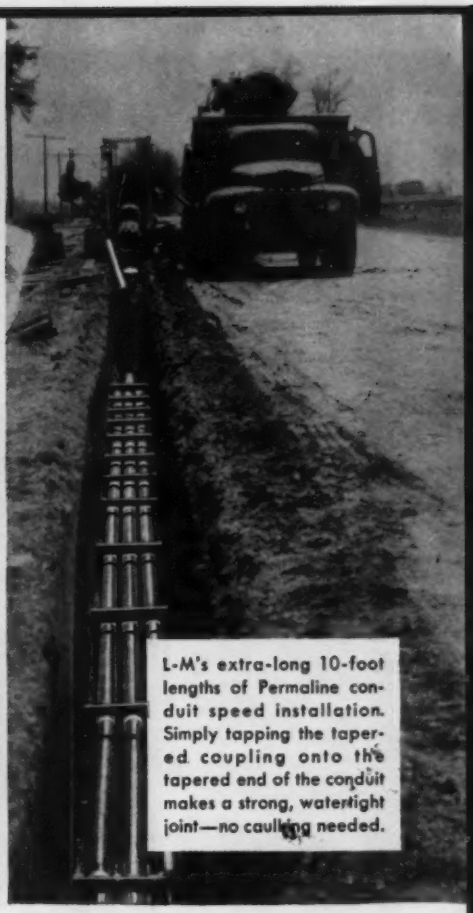
Dc transmission in high-voltage cable is under investigation by Philadelphia Electric Co as a means of circumventing rights-of-way deficiencies for EHV tower lines to connect projected major generating plants in its extensive metropolitan area. Distances are such as to cause excessive charging current in EHV 60-cps cables.

Coal distributing belts will be completely uncovered for the bunker feed system atop the boiler of Colorado Public Service Co's new Cherokee plant near Denver. Savings are estimated at $35,000 for the 110-Mw unit.

Excitation will be electronic for the 147-Mw third unit at Pennsylvania Electric Co's Shawville Station.



L-M's Permaline conduit is light, easy to handle, easy to install. One man can easily carry two 10-foot lengths.



L-M's extra-long 10-foot lengths of Permaline conduit speed installation. Simply tapping the tapered coupling onto the tapered end of the conduit makes a strong, watertight joint—no caulking needed.

Saves Time and Labor...

Contractor Eliminates 13,750 Joints

With Long 10-foot Lengths of L-M Permaline Conduit!

Now, with L-M's exclusive 10-foot lengths of Permaline fibre conduit, you can eliminate 20% to 50% of the joints to be made on a job, and thus cut costly construction time and labor.

On one job requiring 550,000 feet of conduit, the contractor eliminated 13,750 joints by using L-M's long 10-foot lengths as compared with 8-foot lengths.

It will pay you to use L-M's time- and labor-saving 10-foot lengths of Permaline conduit for your next duct job. Only L-M Permaline is available in these 10-foot lengths.

Easy to Install

L-M lightweight Permaline fibre conduit is also easy to install. Joints are quickly made by simply tapping the tapered coupling onto the tapered end of the conduit. Joints are watertight and safe from seepage. Smooth bore reduces cable sheath abrasion. Completely engineered system for installation includes full line of bends, bell ends, couplings, and base and intermediate spacers.

L-M Permaline fibre conduit comes in 5, 8 and 10-foot lengths. Available diameters include 2, 3, 3½, 4, 4½, 5 and 6-inch sizes.

Get Complete Information

Ask the L-M Field Engineer for a copy of the 12-point plan folder which shows how easy it is to use the Permaline system; or Fibre Conduit Bulletin UG1A, which gives complete specifications. Or write Line Material Industries, Milwaukee 1, Wisconsin.

310

LINE MATERIAL Industries

McGRAW-EDISON COMPANY

McGRAW EDISON

Permaline Fibre Conduit

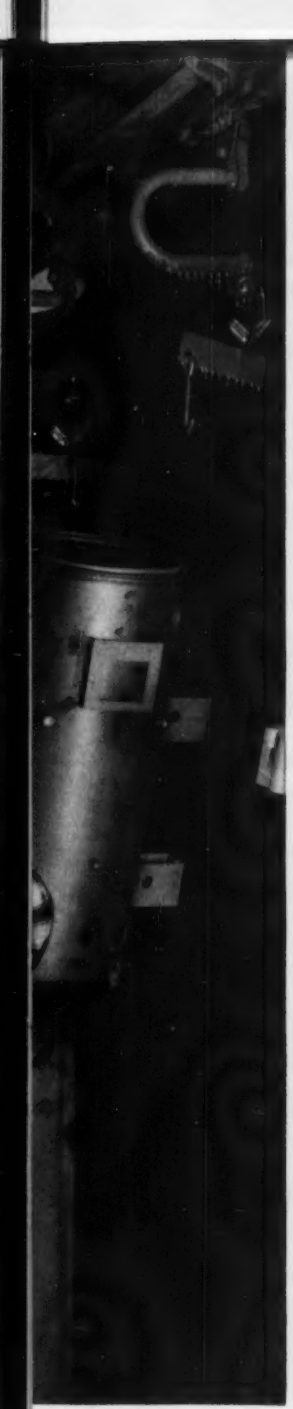
BPI

This seal is your guarantee of recognized quality in Bituminous Fibre Conduit.

Tanks are on a continuous conveyor system. Photo shows heavy-viscosity primer as it is flushed on the transformer tank just prior to entering the vapor chamber.

Flow Diagram, Vapor-Chamber Flow Coating Process

Shot blasting removes scale and oxides
Cleaning with alkali
Phosphate and chromate surface treatment insures maximum adhesion
Primer flushing for heavy coverage
Vapor-chamber flow-out builds up paint on edges and in crevices
Baking oven provides slow, thorough curing
Cleaning
Primer



Another L-M First...

New Vapor-Chamber Flow Coating Protects Tank Edges, Crevices

By **MARTIN I. ZWELLING**
Assistant Manager of
Engineering, Transformers
Line Material Industries

Line Material has adopted a revolutionary new vapor-chamber flow coating process that radically improves tank-corrosion protection on L-M Round-Wound® transformers. The outstanding feature is that the vapor-chamber treatment improves paint film thickness and uniformity on edges, in crevices, and over welds—spots that characteristically are the first to rust.

The process includes seven-stage surface cleaning and preparation; flow coating with heavy, viscous primer and finish paints, each coat passing through the unique new vapor-chamber treatment. The secret of the process is that the vapor in the chamber carries a high concentration of paint volatiles. These keep the paint fluid, and the paint actually flows toward and completely covers critical edges, sharp corners, welds, and crevices.

Automatically Controlled

The heavy paint film is maintained as the tank passes through the baking oven. Humidity and temperature in the oven are closely controlled for proper curing. The entire process is completely mechanized. Automatic controls insure uniform paint coverage.

L-M's newly developed vapor-chamber flow coating process gives better tank protection, partly because it does everything that every previous paint process has done—and does it better—and chiefly because it gives extra protection to areas that are always the first to rust. Here are the principal features:

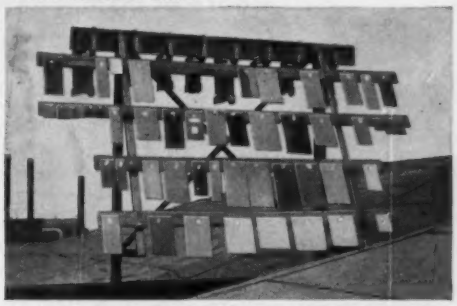
1. Thorough seven-stage surface treatment —shot-blasting, alkali washing, phosphating and chromic acid passivation, with intermediate rinses followed by dry-off to insure maximum adhesion.

2. Even coverage with highest-grade primer and weather-resistant finish paints.

3. Heavy build-up on edges, sharp corners, welds, and in crevices, resulting from flow-out during the vapor-chamber stages.

4. No human element—entire process is completely mechanized and automatically controlled.

All-Weather Paints



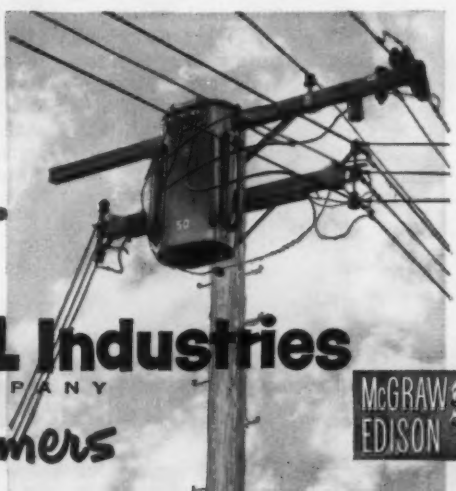
Typical outdoor test rack on which paint panels undergo two-year exposure tests in heavy industrial and seacoast areas. L-M has paints constantly under test—in the laboratory and outdoors.

In the laboratory, paints are subjected to standard tests and special exposures to salt spray and acid fumes which simulate and accelerate atmospheric conditions. From this continuous and extensive testing program L-M selects the paints that best survive these rigorous tests.

Get Complete Information On L-M Round-Wound Transformers

Tank protection is only one of the important features of L-M Round-Wound transformers. Other advantages are exceptional overload capacity, good regulation, low losses—and *Balanced Performance.* Ask the L-M Field Engineer for complete data, or write Line Material Industries, Transformer Division, Zanesville, Ohio.

Finish
Flow-coating with highest grade weather-resistant paint
Vapor-Chamber Flow-out
Final baking insures long resistance to even the worst atmospheres



LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Transformers

304-R

McGRAW EDISON

L-M's New 32-Step Regulator Combines All Desirable Features in One Unit... Plus:

- **reliable, accurate regulation**
- **smooth tap changes, long life**
- **ease of installation and maintenance**

by **N. K. DELANEY**
Product Manager,
Capacitors and
Regulators, Line
Material Industries

Line Material has designed into one compact, efficient regulator all the desirable features found in all other standard makes—plus a few L-M "exclusives."

Sensitive Voltage Control

L-M uses an induction disc-type contact-making voltmeter for reliable, accurate voltage control. The unit is very sensitive, and easily adjustable to a band width of from plus and minus ¾ to plus and minus 6 volts. An integrated time-delay device is used to control the tap-change operation. The time delay can be adjusted independently on both "raise" and "lower" through a range of from 10 to 120 seconds.

Maximum Contact Life

The tap-changing mechanism on L-M's new 32-step regulator is designed to assure smooth operation and maximum contact life. The speed of the tap changer is hydraulically controlled to assure minimum arcing. This, plus a reactor which bridges across adjacent taps during operation, permits smooth tap changes, without current interruption or voltage dip.

Easy to Inspect

The complete internal assembly of the regulator is suspended from the cover to simplify untanking for periodic inspection and maintenance. This desirable feature permits you to inspect all mechanical and electrical parts quickly and easily without draining oil or dismantling the unit.

Less Bending Moment On Pole

The L-M exclusive obround tank design makes the unit smaller, lighter, with shorter moment arm distance from the pole. The unit is easier to handle and install, and the design substantially decreases the total bending moment on the pole.

Greater Current Capacity With ADD-AMP Feature

It is possible to increase the load-carrying capacity of L-M's new regulator up to 160% of its normal rating by reducing the regulation to ±5%. The range of regulation can be reduced externally without de-energizing the regulator.

Get More Information

Ask your L-M Field Engineer for more information on L-M's new 32-step regulator—the regulator with all the best operating and convenience features available on any and all other pole-type regulators. Or write Line Material Industries, Milwaukee 1, Wisconsin.

301

Bushings are corona-free, and are designed for minimum radio interference.

Moving contacts and arcing tips of stationary contacts are made of arc-resistant copper-tungsten alloy to assure long contact life.

Bridging reactor provides smooth tap changes . . . no current interruption or voltage dip.

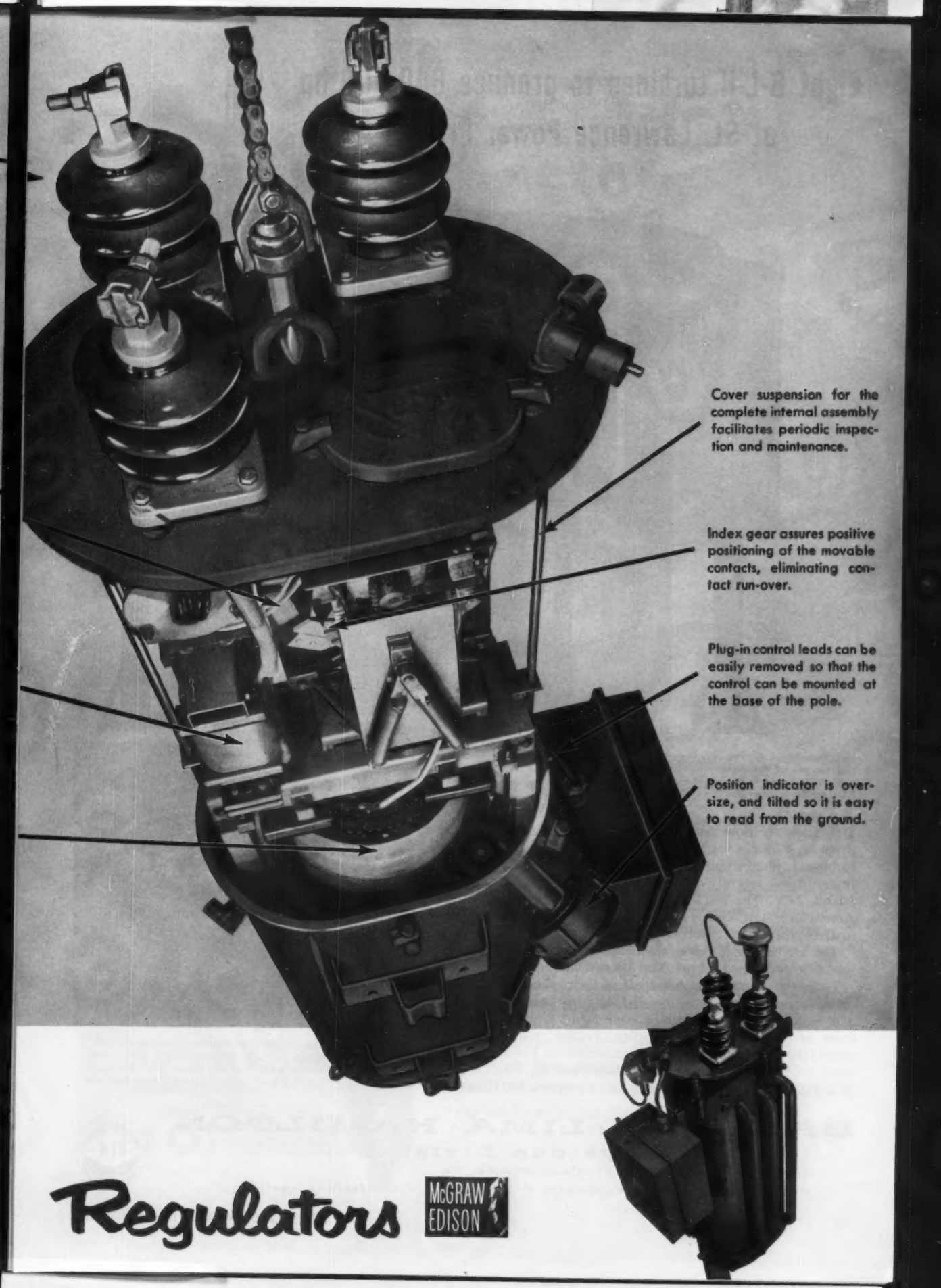
L-M's exclusive Round-Wound core-coil assembly provides a balance of low copper loss, low exciting current, and low core loss.

Available Ratings

2500 volts . . .
100, 150 and 200 amperes
5000 volts . . .
50, 100, 150 and 200 amperes
7620 volts . . .
25, 50, 75, 100, 150 amperes

LINE MATERIAL Industries

McGRAW-EDISON COMPANY


Cover suspension for the complete internal assembly facilitates periodic inspection and maintenance.
Index gear assures positive positioning of the movable contacts, eliminating contact run-over.
Plug-in control leads can be easily removed so that the control can be mounted at the base of the pole.
Position indicator is oversize, and tilted so it is easy to read from the ground.
Regulators
McGRAW EDISON

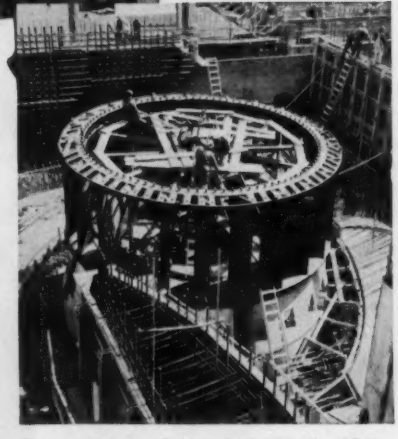
Eight B-L-H turbines to produce 640,000 hp at St. Lawrence Power Project

Shop assembly of stay ring and discharge ring for one of the eight turbines now being built by the Eddystone Division of B-L-H for the St. Lawrence Power Project.

Deliveries are now underway on an order for eight B-L-H fixed blade propeller turbines for the St. Lawrence Power Project. Each of these huge turbines is rated to produce 80,000 hp at 94.73 rpm under 81-ft. head. The first unit was recently delivered to the site of the powerhouse on Barnhart Island, N.Y. The last of the eight B-L-H units for this vast Canadian-American undertaking is scheduled to be completed and ready for shipment in December 1958.

The St. Lawrence Seaway and Power Project is the largest engineering feat ever performed on the North American continent.

Throughout the world, hundreds of hydroelectric plants are operating at maximum efficiency, thanks to B-L-H's 130 years' experience in designing and building hydraulic turbine equipment. Since we build all four basic types of turbine—impulse, Kaplan, Francis and propeller—you can be certain that our recommendations are objective. For additional information, write to B-L-H Corporation, Philadelphia 42, Pa., or Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.



The stay ring on Baldwin-built Unit No. 30 is being accurately aligned at the St. Lawrence Power Dam, Barnhart Island, N.Y. Photograph courtesy Power Authority of the State of New York.

BALDWIN · LIMA · HAMILTON

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings

"We like the convenient storage characteristics of POC Bushings ---no special procedure or special handling is required."

"These totally-enclosed oil-filled bushings for lower voltages will surely create a trend."

"THE CADILLAC OF BUSHINGS!"

"We gave it more severe tests than any other bushing we ever tested --- and we approve it without modification or alteration."

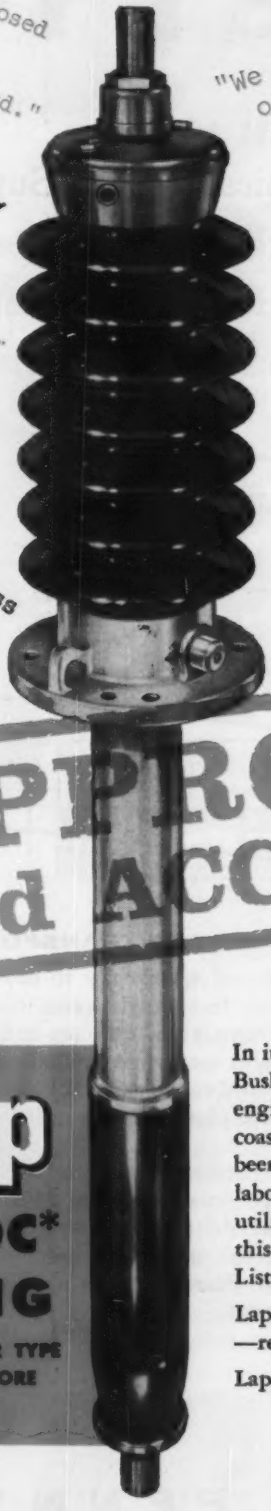
"Excellent Design."

"AN EXCELLENT DESIGN, AND MANUFACTURED IN THE BEST OF FACILITIES."

"An ideal design, and well-suited to applications where existing bushings cannot be used."

"A superior bushing, but we'd expect nothing less from Lapp."

"Seems to be an excellent bushing; we can find no faults whatever."



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TOTALLY-ENCLOSED CORE
ASA STANDARD

In its first six months after announcement, the Lapp POC* Bushing has won the enthusiastic endorsement of utility engineers and equipment manufacturers from coast to coast. Rigorous characteristic and performance tests have been conducted in customer laboratories or in the Lapp laboratory under customer supervision. Practically every utility and every equipment manufacturer who have seen this bushing have placed it on Approved or Standards Lists—or tell us they are in process of approving it.

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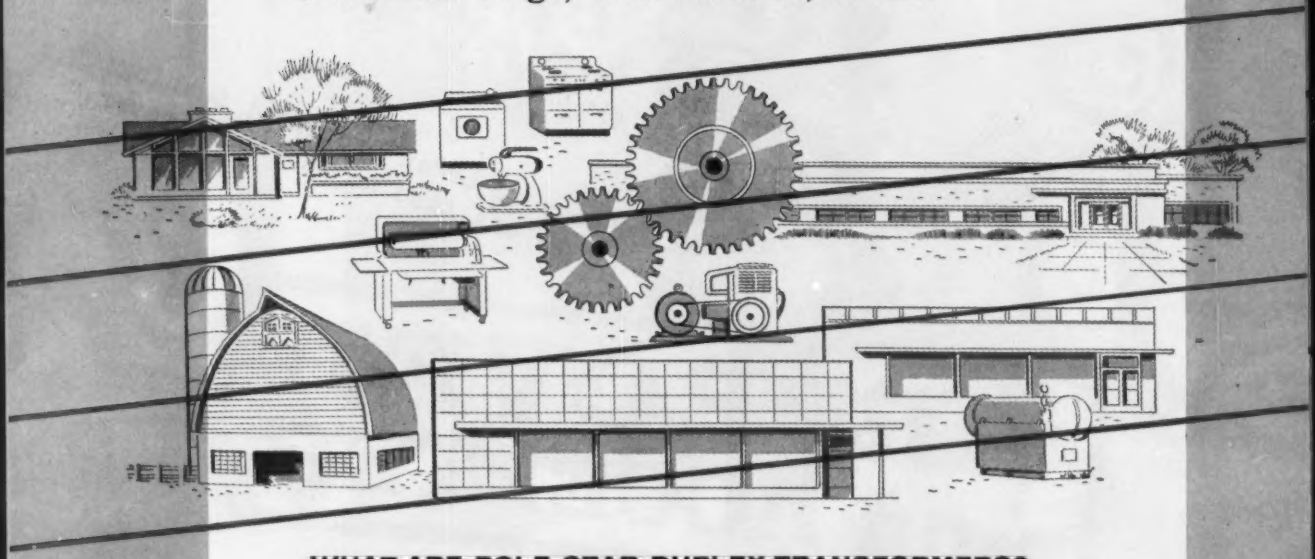

WHAT ARE POLE STAR DUPLEX TRANSFORMERS?

Pole Star Duplexes were developed specifically to provide single- and three-phase power simultaneously from single-transformer pole installations. They are composed of two standard core-and-coil assemblies mounted in a single tank—the most common combination being 37½-kva and 15-kva units to provide a total capacity of 52½ kva. Relative proportions of single-phase and three-phase power can be varied according to load conditions.

Ratings range from 20 kva (15- and 5-kva units) to 100 kva (75- and 25-kva units). The high voltage (available from 2400 to 13200 volts, without taps) may be either open delta or open wye, with a low voltage of 240 volts open delta. A 120-volt mid-tap is brought out for single-phase lighting service. All Pole Star Duplexes are available with or without CSP protective equipment.

McGRAW EDISON

PENNSYLVANIA POLE STAR TRANSFORMERS

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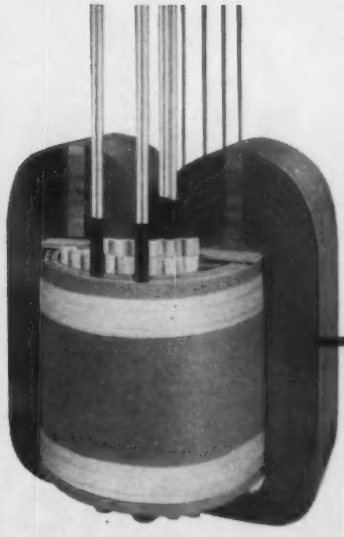
Greater use of air conditioners, do-it-yourself power tools and other electrical equipment is rapidly increasing the need for multiphase service to homes and commercial establishments. Now, new Pole Star Duplex Transformers make the addition of such service easier—and more economical—by providing simultaneous single- and three-phase power from single pole-mounted transformers.

By eliminating the need for banks of two or three units, Pole Star Duplexes simplify installation . . . lower initial costs as well as long-range maintenance costs. Mounted directly to the pole, the new duplexes require no extra crossarms . . . make a neater appearance than do banks of transformers.

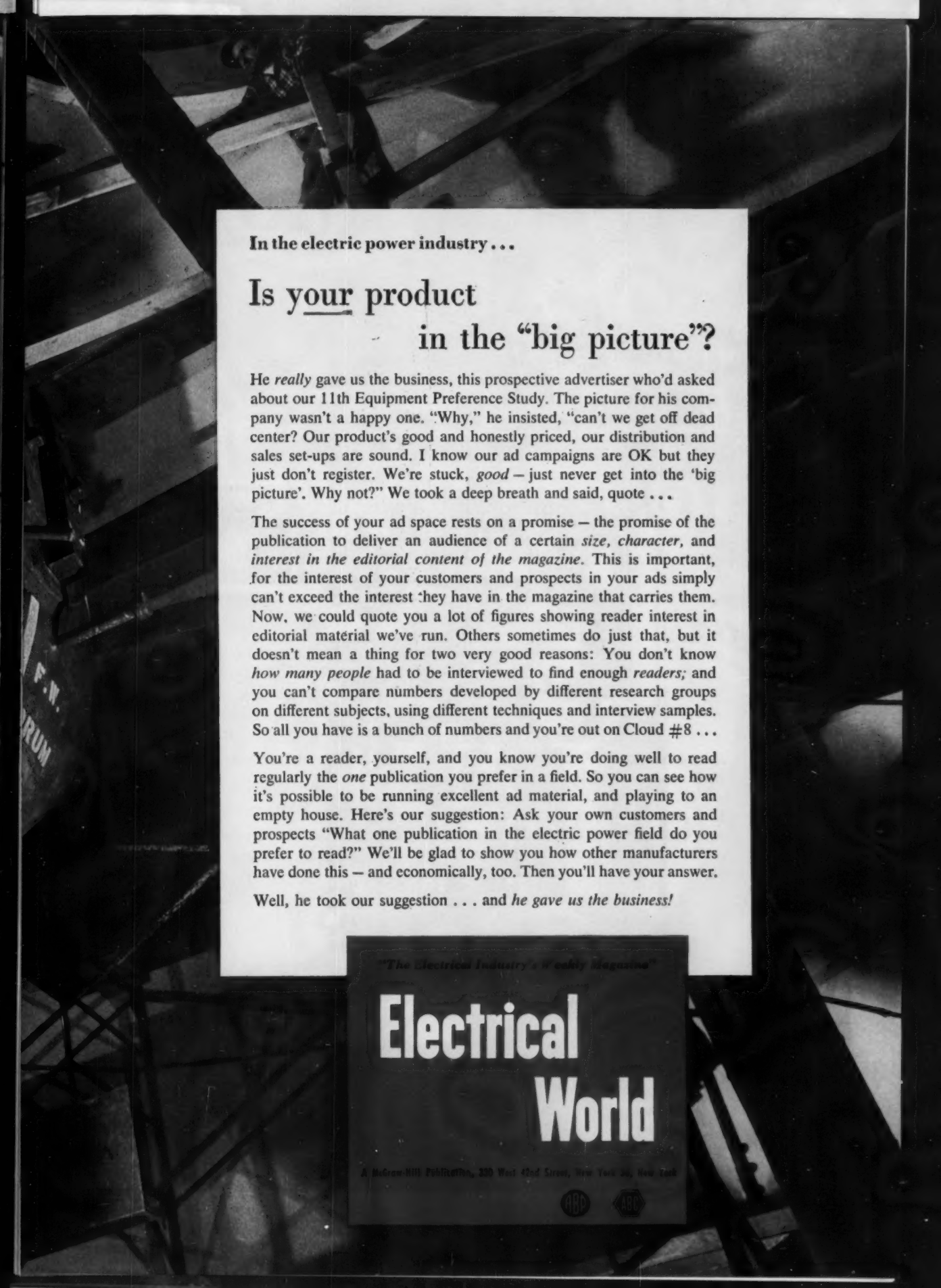
When helping your customers to live better electrically, it will pay you to install Pole Star Duplexes wherever multiphase service is required from pole-mounted units. For more details, write to Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.



Like all other Pole Stars, the new duplex transformers feature Pennsylvania's patented lap-on-top core, with "built-in" low exciting current and low core loss. All design and construction features are comparable to standard Pole Stars . . . noted for sustained performance in every type of distribution transformer installation.

DISTRIBUTION TRANSFORMERS

This all-stainless, straight-tube heat exchanger, part of America's first full-scale atomic power station at Duquesne Light's Shippingport Plant, will transfer 263,300,000 BTU's per hour from high-pressure water into steam. Photo by Robert Yarnall Richie.



In the electric power industry . . .

Is your product in the "big picture"?

He *really* gave us the business, this prospective advertiser who'd asked about our 11th Equipment Preference Study. The picture for his company wasn't a happy one. "Why," he insisted, "can't we get off dead center? Our product's good and honestly priced, our distribution and sales set-ups are sound. I know our ad campaigns are OK but they just don't register. We're stuck, *good* – just never get into the 'big picture'. Why not?" We took a deep breath and said, quote . . .

The success of your ad space rests on a promise – the promise of the publication to deliver an audience of a certain *size, character,* and *interest in the editorial content of the magazine.* This is important, for the interest of your customers and prospects in your ads simply can't exceed the interest they have in the magazine that carries them. Now, we could quote you a lot of figures showing reader interest in editorial material we've run. Others sometimes do just that, but it doesn't mean a thing for two very good reasons: You don't know *how many people* had to be interviewed to find enough *readers;* and you can't compare numbers developed by different research groups on different subjects, using different techniques and interview samples. So all you have is a bunch of numbers and you're out on Cloud #8 . . .

You're a reader, yourself, and you know you're doing well to read regularly the *one* publication you prefer in a field. So you can see how it's possible to be running excellent ad material, and playing to an empty house. Here's our suggestion: Ask your own customers and prospects "What one publication in the electric power field do you prefer to read?" We'll be glad to show you how other manufacturers have done this – and economically, too. Then you'll have your answer.

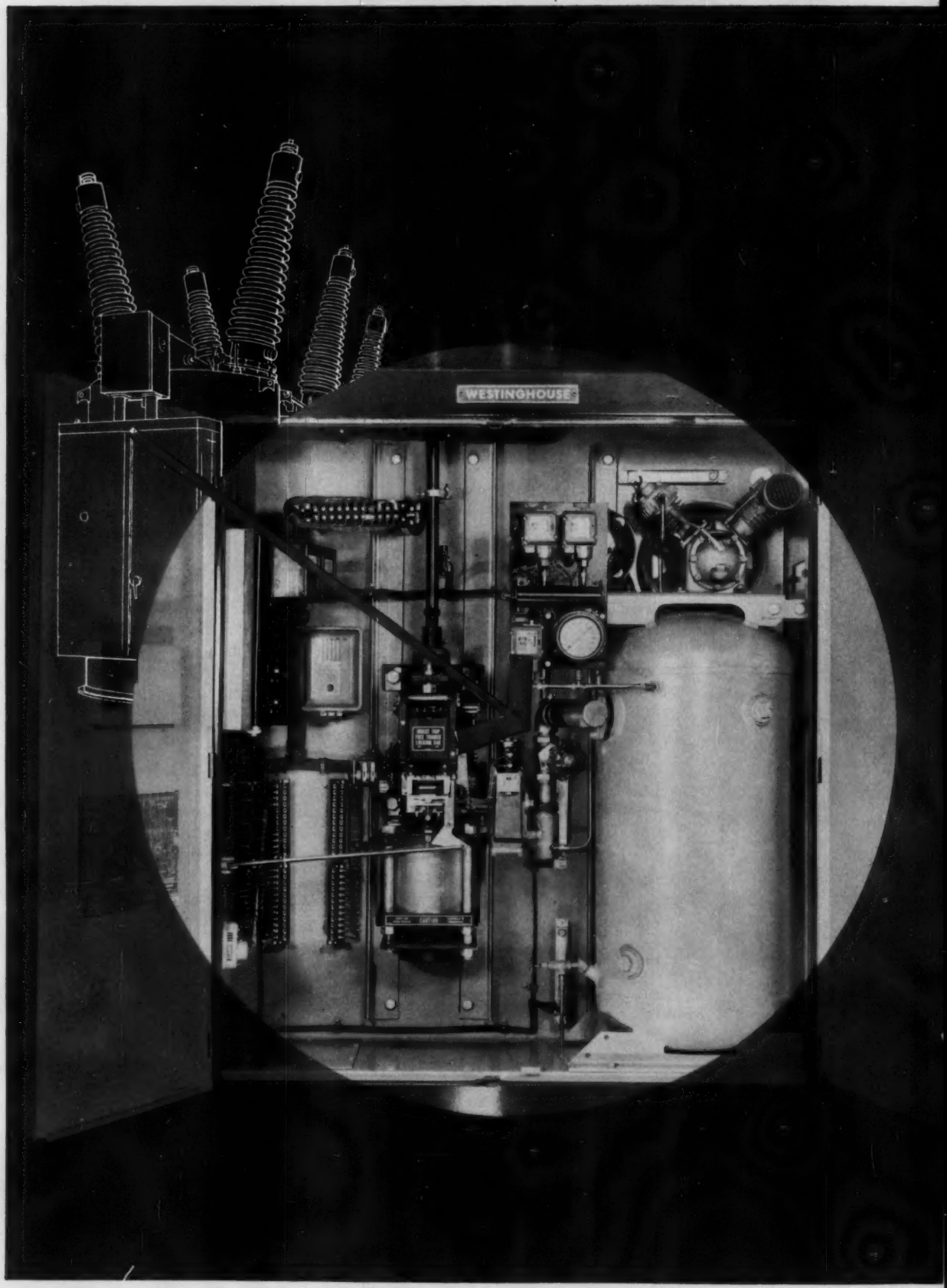
Well, he took our suggestion . . . and *he gave us the business!*

"The Electrical Industry's Weekly Magazine"

Electrical World

A McGraw-Hill Publication, 330 West 42nd Street, New York 36, New York

ABC ABP


WESTINGHOUSE

Power Circuit Breaker Pneumatic Operating Mechanisms

TROUBLE FREE AND TRIP FREE, MECHANICALLY AND ELECTRICALLY

The proof of the pudding is . . . six full years of trouble-free service in the field since introduction to the industry.

Three basic models of Westinghouse pneumatic operating mechanisms, the AA-7, AA-10, AA-14, handle the full line of Westinghouse oil circuit breakers—14.4 kv, 500 mva to 345 kv, 25,000 mva.

Both mechanically and electrically trip free, the breaker will trip open in standard operating time when closed against a fault. A single mechanism operates all three poles simultaneously, eliminating system unbalance due to nonsynchronized closing. These rugged and powerful mechanisms are fast, too—reclosing in 15 or 20 cycles. Roller-bearing latches need no field adjustment for life.

Automatic selection of trip-free or non-trip-free operation results in ultra-high-speed reclosing on larger breakers.

Your Westinghouse sales representative has complete details and specifications—or you may write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-60919

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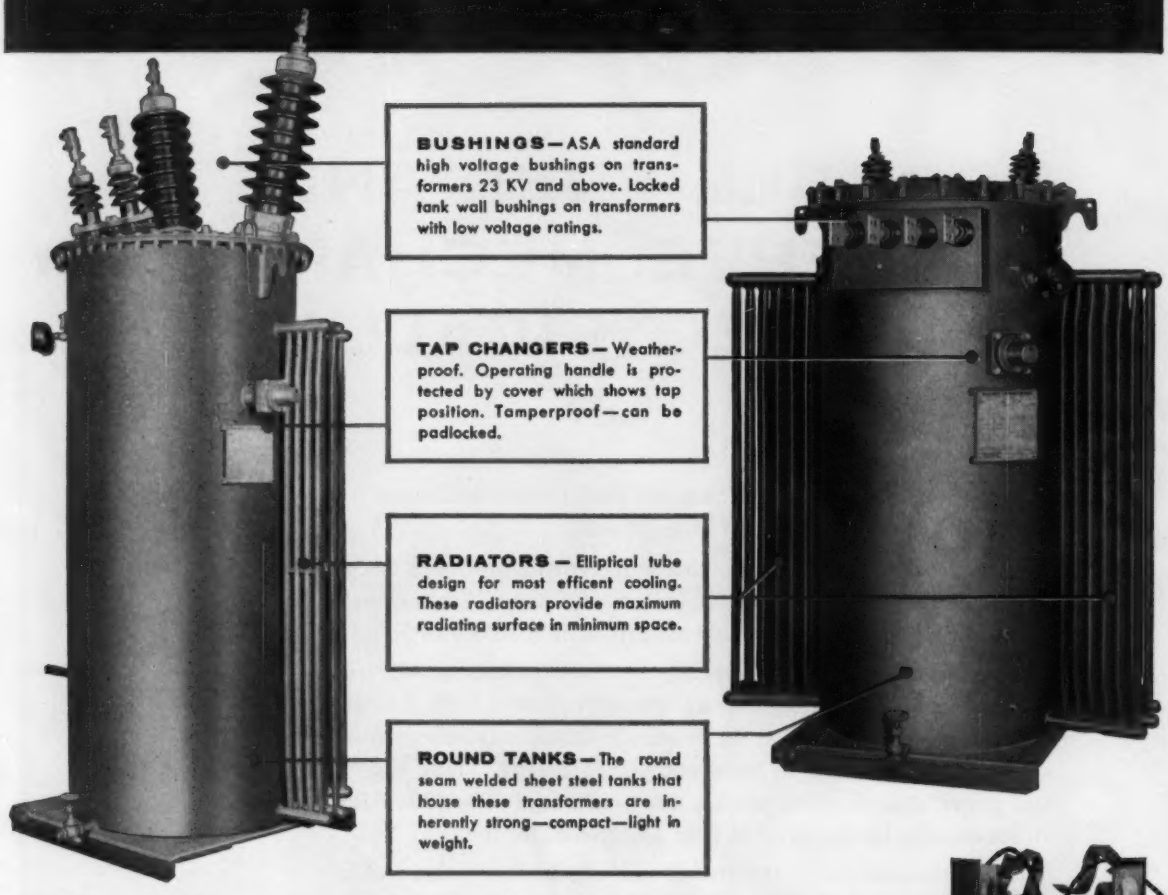
Wagner Form W Substation Transformers

are lighter...more compact...easier to handle



BUSHINGS—ASA standard high voltage bushings on transformers 23 KV and above. Locked tank wall bushings on transformers with low voltage ratings.

TAP CHANGERS—Weatherproof. Operating handle is protected by cover which shows tap position. Tamperproof—can be padlocked.

RADIATORS—Elliptical tube design for most efficent cooling. These radiators provide maximum radiating surface in minimum space.

ROUND TANKS—The round seam welded sheet steel tanks that house these transformers are inherently strong—compact—light in weight.

Ratings through 500 kva, voltages to 69,000

Wagner Form W Transformers are available for every requirement of modern distribution systems—500 kva smaller, 69 kv and below.

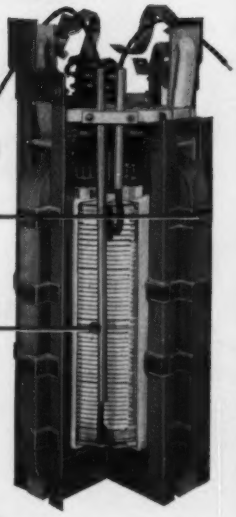
These Wagner Transformers are designed with the Form W core and coil assembly that requires less size and weight per kva—permits compact, light weight transformers that are easy to handle and install.

Form W Transformers will meet your distribution system requirements. Bulletin TU-141 gives full information. Write for your file copy today.

FORM W CONSTRUCTION

CORES are of cold-rolled, oriented grain steel, assembled through and around the coils. In sizes from 250 to 500 kva, there are 4 core sections spaced 90° apart.

WINDINGS... high voltage and low voltage coils are wound on insulating cylinders of high mechanical and dielectric strength, with windings best suited to each transformer's rating, voltage and current.



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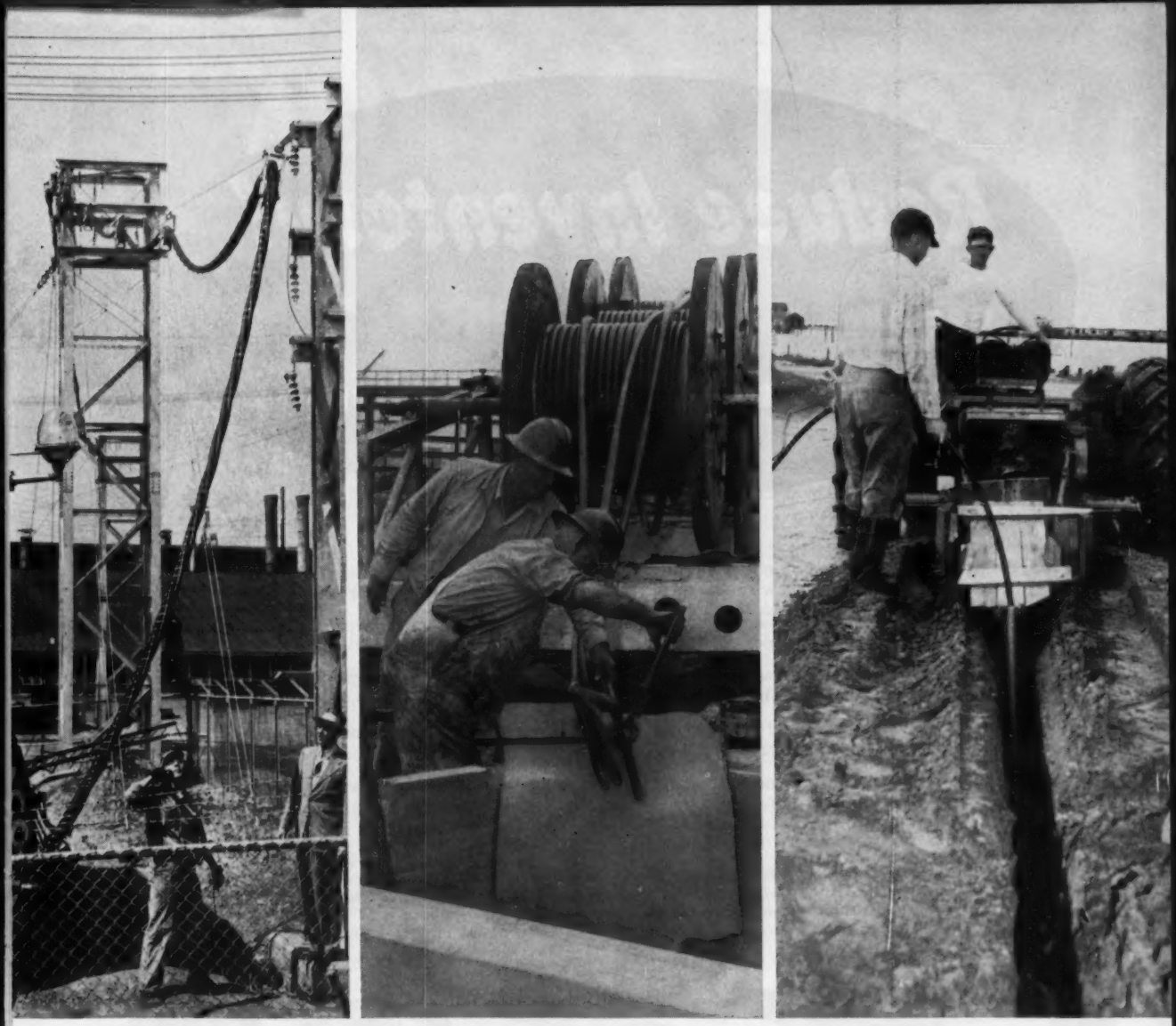

Overhead . . . in ducts . . . underground

Order one cable for all three jobs . . . Anaconda Durasheath

Overhead . . . in ducts . . . underground. Use Durasheath* neoprene-jacketed cable for every type of power application up to 15 kv. Tough jacket resists weather, soil acids, abrasion, mechanical injury.

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Stock one cable instead of three. You save space, paperwork with all-purpose Durasheath. One cable does the work of three. You cut inventory. Versatile Durasheath excels everywhere.

See the Man from Anaconda or your Anaconda distributor for full information. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Trade Mark 57361

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USE BLACKBURN'S PermaCad Aluminum Fittings

CHECK THESE PLUS FEATURES

- All fittings may be used on either aluminum or copper conductors. Each fitting accommodates a wide range of wire sizes—few fittings are needed in stock or on trucks.
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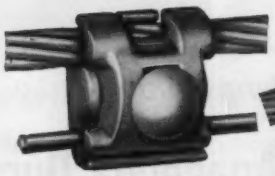
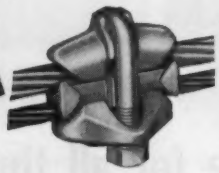
- Non-copper-bearing, heat treated aluminum alloys used in all castings. Hardware available in either hot dipped galvanized steel or high strength aluminum alloy. Bolts alumilited to prevent seizing.

* **PERMACAD** *is a complex, heavy duty plating of cadmium and other metals which has exceptionally long life. PERMACAD protects aluminum because of its favorable electrogalvanic potential and is highly resistant to galvanic corrosion when in contact with copper.*

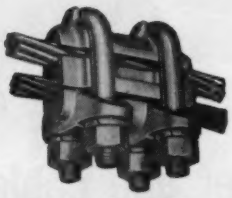


PGP SERIES
One bolt parallel groove clamp. Three fittings accommodate wire ranges from 8 AWG to 397.5 MCM.

PGP 400 SERIES
Two bolt parallel groove clamp. One clamp accommodates conductors from 1 str to 400 MCM.



DLC GP SERIES
Single U-bolt clamp. Four clamps accommodate wire range from 6 AWG to 266.8 MCM.



2U GP SERIES
Double U-bolt clamp. Six clamps accommodate conductors from 1 str to 397.5 MCM.

BLACKBURN PermaCad FITTINGS

IMPORTANT: We recommend the use of CONTAX on all aluminum and bi-metallic connections. CONTAX is an oxide inhibiting compound with an ASTM drop point in excess of 500° F.

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AIEE Board Sets New Policy—Part I

Henceforth the American Institute of Electrical Engineers will limit its activities to the "advancement in technology in all branches of electrical engineering," according to a letter from M. S. Coover, president, appearing in the June issue of *Electrical Engineering*. Activities in the field of professional development and economic status are delegated to the National Society of Professional Engineers.

There are several other important elements in this policy statement of the Board of Directors which will be covered in detail in subsequent editorials. But this one is of such significance that it deserves individual treatment.

This pronouncement of the AIEE Board clearly takes the Institute out of any activity which does not relate to technology. They propose that:

1. The Engineers Joint Council provide the medium for coordination and cooperation on technical matters transcending the electrical field, and to present to the public the position of the engineering profession on technical matters.

2. Engineers Council for Professional Development to provide the medium for guidance in engineering education.

3. National Society of Professional Engineers to provide the medium for the general promotion of the professional aspects of engineering in the eyes of the public and be instrumental in the consequent enhancement of the economic status of engineers.

This latter assignment to the National Society of Professional Engineers is, we believe, the most significant and merits first attention. In effect, the AIEE Board has said that AIEE, an organization with 50,000 members, should turn over a major responsibility to NSPE, a smaller one with which only a minority of AIEE members are affiliated or meet membership qualifications by registration.

In order to overcome this obvious disproportionate representation in NSPE, the Board recommends to AIEE members that they take steps to register as professional engineers. They propose that "NSPE should put itself in a position to represent the profession more completely by expanding its individual membership organization to include those qualified members of the profession whose work does not by law require registration as well as registered engineers."

We believe that a policy with such far-reaching implications should be submitted to the membership of the American Institute of Electrical Engineers for approval before steps are taken to put such a policy into effect. We trust that the new Board of Directors of AIEE will give this matter a careful review and assure themselves that the membership is fully informed and in favor of a policy with such important shifts of responsibility.

House May Vote on Hells Canyon Soon

Rougher sledding predicted as measure—passed 45-to-38 by Senate, goes to Rules Committee; vote trading charged

Democrats are working hard in an effort to get House action this session on legislation authorizing the long-disputed federally financed high dam at Hells Canyon on the Snake River.

Legislation authorizing the federal high dam, defeated last year in the Senate after the 1955 approval by the Federal Power Commission of Idaho Power's program, was voted by the Senate June 20 by a 45-to-38 vote. But it will have rougher sledding in the House.

Success of the Hells Canyon fight in the Senate can be attributed to the combination of circumstances that may be hard, if not impossible, to duplicate in the House. In passing the bill, the Senate reversed a 51-to-41 defeat on Hells Canyon last session.

Southern members, such as Sen Richard Russell (D-Ga.), who voted against Hells Canyon last year, switched and voted for it this year because of the tax writeoff revelations, as did many other Southern Democrats. Three Republican members also switched in favor of the bill—Senators Margaret Chase Smith of Maine, George Aiken of Vermont, and Edward Thye, Minn.

Republican National Chairman Meade Alcorn charged that passage was in part attributable to a vote trade on which Democrat senators from the northwest voted to send the Civil Rights Bill to the Judiciary Committee—as against placing it on the Senate calendar—in exchange for southern votes for Hells Canyon. The liberal Democrats, whom Alcorn charged with selling out on civil rights, were Senators Wayne Morse of Oregon, Warren Magnuson of Washington, James E. Murray of Montana, Joseph C. O'Mahoney of Wyoming, and Mike Mansfield of Montana.

Mansfield, who is Democratic whip and acting majority leader, denied the Alcorn charge and cited the GOP switches.

Idaho Power has decided not to use its certificates but, Hells Canyon proponents in the House plan to try to bring the measure to a vote speedily to cash in on sentiment they think is favorable to them.

Hells Canyon proponents feel they must act swiftly, if they are to realize any gain. Their plan is to conclude hearings before the Interior Committee either this week or next, and push the bill to the Rules Committee. Democrats hope they can get a party line stand, both in the Rules Committee and on the floor, to help passage. They are telling members who have been against Hells Canyon all along that they can help the party on a political issue and still not bring about the construction of the controversial project. They remind them that President Eisenhower is almost sure to veto the measure, ending any chance of enactment.

Ike Pulls Political Punch by Naming 2 Truman

By naming two former Truman Administration officials to vacancies on the Atomic Energy Commission, President Eisenhower has gone a long way toward neutralizing Democratic criticism of his failure to reappoint AEC Commissioner Thomas Murray.

All indications had pointed to a major showdown between the Administration and Congressional Democrats over filling the positions.

Democrats had been insistent in their demands that Murray be reappointed. They threatened that without this reappointment, any nominee for the vacancy of the late Dr John von Neumann would have a tough time obtaining Senatorial confirmation.

Now Eisenhower has put his opposition in the position of having to fight appointment, if they wish, of members of their party, both of whom have been confirmed by the Senate before. Washington experts regard the President's move as shrewd politics.

FLOBERG: Self-styled independent

The man who will replace Murray, last Truman appointee on the AEC, is John F. Floberg. Under Truman, Floberg served as Assistant Secretary of the Navy for Air. Currently, he is practicing law in Washington but comes from Chicago.

Floberg describes himself as a political independent. His term will run five years.

The other appointee is John S. Graham, 51, a North Carolina Democrat. Graham was Assistant Secretary of the Treasury from 1948 to 1953. A lawyer by training, he is a financial consultant in Washington.

Unlike Floberg, Graham has been active in Democrat party affairs. Before the presidential election last year, he served as treasurer of the Volunteers for Stevenson.

Graham will serve out the two remaining years of the Von Neumann vacancy.

Eisenhower's action caught official Washington by surprise. Rarely are top appointments made without

Quick Action on Niagara Compromise Seen

Power Authority's chances soar as Senate unit okays measure and courts empower FPC to license project

After years of trying, Congress finally gives every appearance of passing a piece of Niagara legislation this year.

Last week the Senate Public Works Committee approved the compromise bill sponsored by Sen Robert Kerr (D-Okla.). Full Senate action was expected to follow quickly. The bill authorizes New York State Power Authority to build the $600-million project, and includes a provision for preference customers to get at least 50% of the power.

Approval came a few days after a federal court of appeals opinion that Federal Power Commission had the authority to license the project. Congress has held, and so did FPC, that in this instance only Congress could authorize the project because of a treaty reservation with Canada.

NYPA Chairman Robert Moses took FPC into court on the issue as part of his strategy to force a decision out of Washington.

It is doubtful, however, that the court action will have much bearing on the outcome—even if FPC appeals the decision to the Supreme Court. Congressional approval would make moot any court decision. And FPC is not likely to rush in and act while there is legislation pending in Congress.

Climaxes Stormy Fight

The Niagara fight has been long and stormy. It has been one of the major power issues in recent years.

In 1953 the House voted to let five private electric companies develop Niagara power. The Senate rejected this decision.

By 1956 sentiment had changed. The Senate voted to let NYPA undertake the redevelopment but on the House side the bill never got out of the Rules Committee.

It was then that Moses decided he had had enough of the shilly-shallying in Congress and said he would take the matter to the courts.

The big stumbling block to previous agreements has been the long-standing preference issue.

NYPA had insisted it dispose of all Niagara power as it saw fit without regard to preference for public power bodies. Public power supporters insisted that power be distributed in accordance with the federal preference law, giving first call to co-ops, municipals, and similar public power groups.

The bill now before Congress is a compromise of the two positions.

Actually, at this point, it makes little difference from where the final authority to build the project comes. There is no doubt that NYPA will be the U. S. agent.

Men to AEC; 'Shrewd Move,' Say Observers

the names of nominees leaking out well in advance of official action.

As the time neared for expiration of Murray's term (June 30), the clamor for his reappointment had gained momentum in Congress. Earlier in the year, ten Democrats on the Joint Committee on Atomic Energy plus one Republican had written the President urging the reappointment.

This demand went to the heart of the Democratic criticism of AEC. Congressional Democrats don't like AEC Chairman Lewis Strauss and feel he keeps them in the dark on AEC affairs and actions.

Murray, on the other hand, has opposed Strauss on many issues and in so doing has appeared to side with the Administration critics.

Sen Clinton P. Anderson (D-N. M.), ranking Senate member on JCAE which will pass upon the nominations, has promised that Floberg and Graham, would face "close questioning to see if they will be truly independent members."

GRAHAM: Volunteered for Adlai

The present fear of Democrats is that neither Floberg nor Graham will be able to exercise the kind of independence Democrats believe is needed at AEC. They charge that neither of two other commissioners, Dr Willard Libby and Harold Vance, are showing any independence of what they consider Strauss' domination of AEC affairs.

Unquestionably the two new commissioners will get their first major test on the Power Reactor Development Co case.

Murray was closely connected with this case following his disclosure before a Congressional hearing of the existence of a report questioning safety of the project.

The subsequent AEC hearing, called at the request of three labor unions, is now nearing completion.

Congressional Democrats have been watching the case closely. They will take a close look at how the commission rules and the manner in which Floberg and Graham vote will have considerable bearing on what Congress does subsequently.

New G&T Co-op Formed in Pacific Northwest

It is joint enterprise of 12 rural electric cooperatives to investigate feasibility of building own generation and transmission facilities

Twelve rural electric cooperatives in Washington, Oregon, and Idaho have announced formation of a corporation for the generation and transmission of electric power for its participating members.

The new enterprise is Lewis-Clark G&T Cooperative, Inc. Incorporation papers were filed June 12 in the state of Washington.

Articles of incorporation state that the purposes of the cooperative include the generation, manufacture, acquisition, exchange, sale, and accumulation of all types of electric energy and other products and services for its members, including atomic, steam, and hydro power; to transmit, distribute, furnish, sell, and dispose of such electric energy and other products to its co-op members.

N. V. Fisher, manager of Lincoln Electric Cooperative, Inc., Davenport, Wash., who is temporary chairman of the group, said the corporation is the result of four years of organizational work. The new G&T co-op will be the first of its kind in the Northwest.

The 12 member rural electric distribution co-ops serve 33,800 customers in the three-state area and their combined plant investment totals more than $25 million.

No Applications Filed

Fisher said preliminary engineering studies have already been conducted at several potential hydroelectric sites, but no applications have been filed with the Federal Power Commission for preliminary permits. The G&T will also consider possible use of thermal generation including atomic power if the cost is feasible.

"Our purpose is the establishment of a new corporate entity through which our members may develop and transmit their own common supplies of electric energy under terms of the federal rural electrification laws," Fisher said.

He said that the cooperatives had been depending upon federal power from Bonneville Power Administration, but that the supply of power has not kept up with the demand.

"There isn't power enough for any new industries in the Northwest," Fisher said. "Rapid growth in the demands for power in our market area have made it mandatory for us to make plans for at least part of our future supplies.

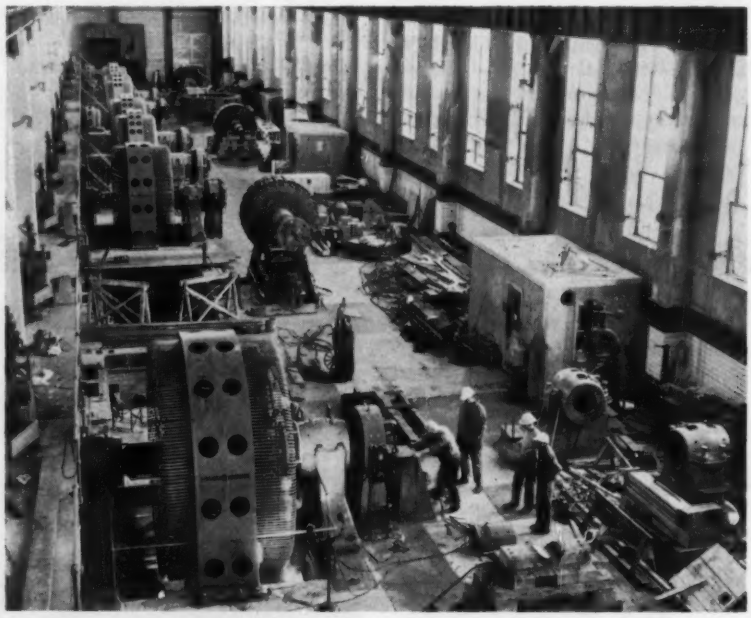
Participating cooperatives are:

Washington: Inland Power & Light Co, Spokane; Benton Rural Electric Assn, Prosser; Big Bend Electric Cooperative, Inc, Ritzville; Columbia Rural Electric Assn, Inc, Dayton; Lincoln Electric Cooperative, Inc, Davenport, and Nespelem Valley Electric Cooperative, Inc, Nespelem.

Idaho: Northern Lights, Inc, Sandpoint; Clearwater Power Co, Lewiston; Idaho County Light & Power Cooperative Assn, Inc, Grangeville; and Kootenai Rural Electrification Assn, Inc, Coeur d' Alene.

Oregon: Eastern Oregon Electric Cooperative, Pendleton; and Columbia Basin Electric Cooperative, Inc, Heppner.

A permanent board of directors will be picked for the new cooperative at a meeting to be held in Spokane.



A Year Later—Schoellkopf Spins 48 Mw

One year after the rockslide that crumpled Niagara Mohawk Power Corp's Schoellkopf Station, construction crews and engineers have six 8,000-kw generators back in service. Work is moving forward on other units which should bring capacity to 80,000 kw by the end of this year. Previous capacity was 360,000 kw.

The $4-million reconstruction centers in Section 3A of the famed Niagara Falls facility. The section shown above was flooded to 14 ft level after the disaster June 7, 1956. Company officials called the rebuilding "an outstanding engineering and construction achievement."

GE Reveals Its Start Toward Harnessing Fusion Process

"Substantial research" has been going on for a year. Suits sees "technical feasibility" perhaps ten years away, and pilot plants 20 years hence

CAPACITOR BANK is being built for heavy electric jolts in fusion research

For more than a year, a "substantial research program" aimed at exploring the fusion process has been progressing quietly at General Electric Co's research laboratory in Schenectady, N. Y. Its ultimate object is the achievement of safe, inexpensive power from this fundamental H-bomb process.

GE's participation in this research field was revealed recently by Dr Guy Suits, vice president of the company.

"My own view," said Dr Suits, "is that five additional years of research will be required to make possible a realistic appraisal of the fusion process; in ten years we may be at the point of technical feasibility; pilot-plant production of fusion power will not begin for 20 years; and competitive power production lies beyond that."

Fusion experiments require the most basic technical skills of the electrical industry, he said, making it singularly appropriate for the industry to contribute to development of fusion technological know-how.

The processes of generating and containing a thermonuclear plasma, for instance, employ magnetic fields, electric discharge phenomena, power circuit design, and current handling methods, he said.

The success in achieving a successful laboratory fusion reaction may lie in working with gases at a million or more degrees. At a million degrees, a gas is "electrical" because it is ionized fully. At ten million degrees it will conduct electricity about as well as copper. Such an electric gas can be controlled with a magnetic field.

Research experts now are looking for a suitable device to hold and control hot cosmic plasma.

British Confer on Fusion

Meanwhile from London, McGraw-Hill World News reports active British interest in industrial uses of the fusion process. Thirty companies were invited to send representatives to a secret three-day conference recently (attended also by 25 U. S. Atomic Energy Commission delegates).

It is known that Britain is building a laboratory prototype at Harwell for controlled release of power from fusion of hydrogen atoms.

The apparatus will create a thick "soup" of hydrogen compounds which will conduct heat a thousand times better than copper. Biggest expected problem will be maintaining temperatures of 10-to-30 million deg C in the reactor to keep the reaction going.

It is believed that several megawatts of power can be produced from each square centimeter of hydrogen-compound soup.

System Being Designed for Pebble-Bed Reactor

A reactor system capable of generating 50,000 kw of heat and producing steam at 1,450 psi and 1,000 F is being designed by ALCO Products, Inc, and Sanderson & Porter, a New York firm. The pebble-bed graphite reactor's heart is a group of parallel tubes filled with small graphite spheres containing uranium. These are heated by fissioning of the uranium. Heat is transferred to a steam generator by helium gas, continuously recirculated. ALCO Products says this system is designed to meet the needs of big electric power plants.

Little David Slays Big Bad Weld

When X-rays showed a "suspicious" weld in the piping of Shippingport's reactor coolant system, officials of Dravo Corp (which is installing the nuclear part of the plant for Westinghouse) huddled with union representatives. They learned that Eugene David at AEC's Savannah River project might be able to thwart a complex repair job. David, 42, is 40-in. tall, weighs 60 lb. Upon arriving from Georgia, he crawled 10 ft into the 15-in.-I.D. pipe, found and repaired a damaged weld, then flew back to his wife and five children. That's David squirming out of the pipe at right.

Before . . .

. . . and After

Familiar "Spirit of '76" Is Relighted

The famed oil painting, "Spirit of '76," which has become one of the symbols for our Fourth of July celebrations, takes on a new brilliance this year. As may be seen from the photos above, the large painting has been relighted to bring out more details and to create a more pleasing appearance for the visitors to Abbot Hall in Marblehead, Mass., where the painting is on display.

Tourists viewing the 7 x 10-ft painting see it lit by fluorescent lamps in vertical trough fixtures, which flood the entire wall, and by incandescent lamps, which are used to highlight the picture.

General illumination from the 8-ft fluorescent fixtures is about 5 ft-c at the center of the picture. The incandescent spots deliver as much as 12 ft-c on the picture to bring out the highlights. The relighting was a joint project of the town of Marblehead and the lighting division of Sylvania Electric Products Inc.

See Transformer Noise Levels Going Down

Transformer makers tell EEI improvement will be gradual; uniform levels held to be unlikely; steel is credited

Reduction in power transformer noise levels will come through evolution rather than revolution, a symposium of transformer manufacturers agreed at the May 21 meeting of the Edison Electric Institute in Buffalo, N. Y. They predicted steady improvement in the average noise level of modern transformers and more consistent performance from similarly rated units.

The manufacturers recognized noise as their prime design problem, and there are obvious limits to how far designers can go in securing lower noise levels without violating basic design principles. Beyond that limit excess capacity must be built into transformers to obtain lower noise levels by decreasing flux density. This means more material and more money.

Need for an outdoor air switch design that can go long periods without maintenance was expressed by K. W. Kayler, Duquesne Light Co. The immediate aim of his company, he said, is to put power transformers and associated air switches on the same four-year maintenance schedule to reduce outage time. A 12-year switch maintenance schedule should be the ultimate goal.

Short-circuit tests on disconnect switches, conducted by Public Service Electric & Gas Co, in cooperation with Delta-Star Electric Co and

Railway & Industrial Engineering, led to these conclusions as reported by Oscar Bauhan, Public Service E&G:

1. Short circuit capacity of 30-year-old switches compares favorably with modern designs when contacts are in good condition.

2. Replacing existing 26 and 132-kv switches would cost 20 times as much as it would to correct their deficiencies.

3. In older designs of disconnect switches, braids have proved to be the weak spot under short-circuit conditions.

4. Where braid was satisfactory, switch blades withstood higher short-circuit currents.

5. Most switch failures occurred under short circuits of more than 100 cycles, indicating that high-speed relaying is justified.

Three reasons for use of turbine drives for boiler feed pumps in connection with the 200-Mw additions to C. R. Huntley station were given by H. A. Piesecki and W. C. Van Dyke, Niagara Mohawk Power Corp.

1. It is more economical because motor drive cuts down generator net output.

2. It takes about half the space.

3. It eliminates need for variable-speed coupling and stepup gear.

Other Features Cited

Other features of the Huntley station are use of 230-kv oil-filled cable to link unit transformers with the station switchyard; regulation of the two new units by a new automatic load and frequency control system; selection of microwave communication rather than carrier for pilot relaying of associated 115 and 230-kv transmission circuits.

Harrison Hubbard reported that control of generation at six stations (965 Mw) of Virginia Electric & Power has enabled the system to maintain generation so that "area requirement" (net interchange plus or minus the contribution required due to departure from normal frequency) rarely exceeds 10 Mw. VEPCO is using a control scheme known as "Excess Area Requirement to limit area requirement to 10 Mw. When it does exceed 10 Mw all stations under automatic control disregard economic loading until the system balance is normal.

Library Should Serve All

IRMA A. ZINK, Librarian, Potomac Electric Power Co, Washington, D. C.

Not many electric utilities are aware of the value of company libraries, judging from the few companies which have them. As of June, 1956, fifty utilities (other than transit utilities) in the U. S., Canada, and Hawaii made it possible for one or more of their librarians to belong to the Public Utilities Section of the Special Libraries Association. Probably there are another 50 or so companies libraries in utilities.

The McGraw-Hill "Directory of Electric Utilities" lists 3,890 operating utilities in the U. S. and its possessions and in Canada. As a very rough, and perhaps optimistic, guess—one electric utility in 40 has its own company library.

A survey made in late 1956 to determine where libraries are placed in their respective company organizations brought these replies from 17 utilities: Seven of the 17 treat the library as a separate department. Librarians in two of the company setups report to the executive vice president, one reports to a vice president, five to the company secretary, one to the company treasurer, four come under the personnel director, two under the education department and one under the rate department. One of the 17 did not indicate the immediate superior.

Admittedly, it is dangerous to generalize on the basis of such a small sample. However, this survey can be regarded in the light of a pilot-plant installation and considered as pointing the way for the future. These companies do have libraries that are functioning well enough that the repective managements are willing to finance them. Whether they are functioning at optimum efficiency is something only the companies themselves can judge.

If the companies surveyed are typical, it can be said that:

1. Most public utility libraries are not a part of any one department of the company.

2. In general, the libraries are under the direct control and report to an officer of the company.

Evidence produced by the survey would lead one to assume that the growth of libraries in public utilities has been somewhat Topsy-like, and that location within an organization has been more due to local circumstances than to planning.

Ideally, the library should not be tied to or hampered by departmental considerations or controls. It is an arm of the company as a whole, not of any one branch. It should report to an officer of the company whose breadth of vision and depth of information make it possible for the library to assume its rightful place as a service unit and for the whole company. Its company-wide responsibilities must be emphasized. It must not be considered an instrument of management alone, nor must it occupy such a rarified atmosphere that the rank-and-file hesitate to use it.

THE NEWS-BEAT

Expensive Targets

Armed with rifles and shotguns, unknown vandals (believed to be teen-agers) have plugged more than 50 insulators on New York State Electric & Gas' high tension lines in the Binghamton division. The company describes this vandalism as "the most widespread and destructive in the history of the division," and has called on the sheriff's department for an investigation.

Insulators have been destroyed on 33-kv lines and on a 4,600-volt line. In one case, eight of nine insulators were shot off a single pole. Repairing the damage has cost $1,200 so far.

Trouble in Puerto Rico

Puerto Rico's Water Resources Authority, which has no interconnections (being the sole utility on the island), found itself staring a crisis squarely in the eyes May 29 when a short circuit and fire took out 88 Mw in the San Juan station. This represented 30% of the PRWRA system's dependable capacity. Capability already was down some because a long extreme drought had lowered reservoir water levels.

Plans were made immediately to reduce voltage and frequency, to ask large consumers to cooperate during peak hours, and to shed load, if necessary, to keep system stability.

Load shedding May 29 was held to 6,000 kw for a peak hour or two. System peak requirements were held to about 196 Mw instead of the normal 240 Mw, and on May 31 it was 187. Then more trouble came as a 4,000-kw hydro unit was lost. About 15,000 kw were shed across the two peak hours as selected feeders were switched out. But essential services were maintained.

Through extraordinary measures, one 44-Mw San Juan unit was restored to service to meet the June 3 peak. This ended the peak crisis, but heavy drafts upon reservoirs had lowered their levels drastically. Now the second San Juan unit is working again, but the system will continue operating at reduced frequency and voltage until rains replenish reservoirs.

KP&L Fights Rising Costs

Kansas Power & Light Co has dispatched a squad of cost-cutting experts to tour all divisions and enlist support of the utility's cost-control program. One economy, the company said, might be reducing the amount of materials bought under local purchase orders. Last year such goods amounted to $350,000. Purchasing department estimates it could buy most of the same materials on a competitive basis and in bulk at 5% less.

It was also suggested that regular gasoline be substituted for ethyl in the company's 450 cars and trucks, and that a letter plus a three-cent stamp might shave off part of the long-distance phone bill.

Better Autoing . . . Electrically

Compare this with the auto classification on your next expense sheet:

Trip mileage: 28 mi @ ¼¢ per mile—7¢.

This is how it would look for an electrical engineering student at the University of Idaho. He used a surplus aircraft electric motor in a small car that transports him at speeds up to 40 mph. "All I need for a day's run is about 7¢ worth of electric current to recharge the batteries," he says. He's designing another auto with two motors and direct drive which he hopes will surpass the 1¢ per 4 mi average he now gets.

Dictating by Wire

An electronic system that transforms every telephone into a dictating machine is in use at British Columbia Electric Co's new office. By dialing a code number on any of the 800 phones, executives can dictate, listen, make corrections, or talk directly to girls in the steno pool. Audiograph Canada, Ltd, a distributor for Gray Mfg Co of Hartford, Conn., made the installation.

The Case of the 6¢ Bill

Officials of the Scottish Hydroelectric Board were puzzled when an 84-year-old woman piled up a six-cent consumption of electricity in a three-month period. They sought an explanation, reports Dayton Power & Light Co.

"I've nothing against the new electricity," she said, "but I only switch on the light at dusk. It helps me see to light my oil lamps."

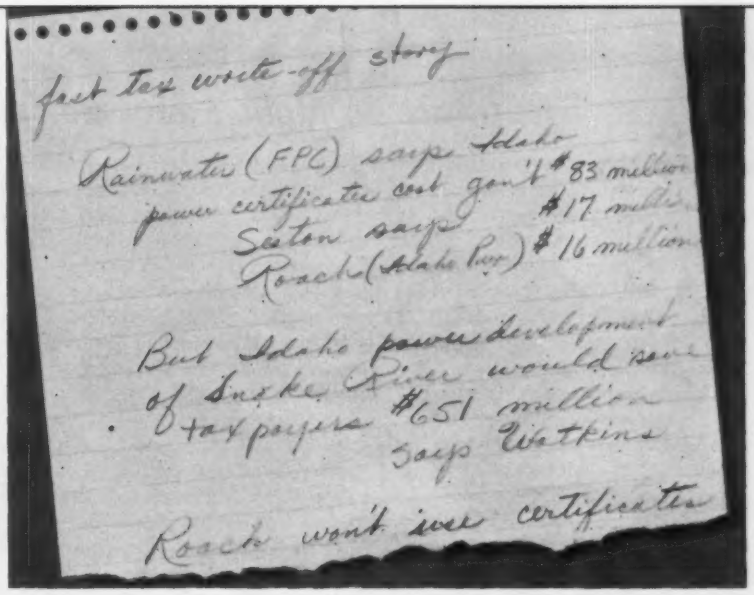
Figuring Coal Pile Density

Here's how Consumers Power Co figures the weight and density per cubic foot of coal piled up at its steam stations. Employees dig a hole in the coal pile nine feet deep and 20 in. in diameter. They insert a plastic bag into the hole and fill it with water. The water presses the bag into the contour of the hole. Knowing how much water was needed to fill the bag, and by weighing the coal removed, the men can figure the coal pile's density. It ranges from 62 to 68 pounds per cubic foot, depending upon type of storage.

Federal power proponents, using fast tax writeoffs as their only new foil, have managed to win passage of the Hells Canyon Bill in the Senate.

The bill now goes to the House, where this tax legistion again may play a decisive role.

Here's a special story that answers a timely question:


fast tax write-off story
Rainwater (FPC) says Idaho
power certificates cost gov't $83 million
Seaton says $17 mill
Roach (Idaho Pow) $16 million
But Idaho power development
of Snake River would save
taxpayers $651 million
says Watkins
Roach won't issue certificates

Why the Hassle over Fast Writeoffs?

"Fast tax amortization" has flashed into sudden prominence because it has become a potent weapon in the federal-vs-private power fight.

It was used by federal power advocates with telling effect a few days ago to gain Senate approval of a federal Hells Canyon bill.

As a weapon of confusion, it is almost certain to see further use in the House, which next gets the bill.

The ultimate irony of the fast tax amortization hullabaloo is that it is raised by the very people who advocate the type of electric utilities that would pay no federal income tax.

There are several reasons why fast tax amortization suddenly became a pivotal issue in the power battle; the most obvious are:

- It is the single new issue that could be dragged into the Hells Canyon fight—a fight in which the federal power advocates have suffered numerous defeats in Congress, before the Federal Power Commission, and in the courts.
- In this year of a high peacetime budget and continued high taxes, it is a money issue that has potentially wide public interest.
- It is a complicated affair that permits conflicting interpretations which breed confusion.
- It serves well as a diversionary tactic which leads the public away from the facts that public bodies pay no federal income tax and that cooperatives are now borrowing federal funds at considerably less than the average rate of interest which the government pays for the money.
- It is a last-ditch, desperation issue used because pertinent issues have failed to produce the desired effect in previous battles.

Behind the headlines and the wild calls in Congress are these fundamentals about fast tax amortization —or fast tax writeoffs, as they are sometimes called:

1. Writeoffs provide no escape from taxes nor any reduction of taxes. Rather, they allow the certificate holder to defer payment of a specified portion of its taxes for a period not exceeding five years.

2. Laws providing for writeoffs have been passed by two Democratic-controlled Congresses.

3. This legislation was designed to encourage industries to expand rapidly enough to meet national defense requirements if an emergency arises, and to compensate them for building unnecessary facilities if the emergency never arises.

4. Use of a fast tax writeoff allows the certificate holder to use up its amortization deductions on a specified portion of its plant in a five-year period rather than over the entire life of the plant. Of course, after the deductions are exhausted, the holder must then pay his taxes without any benefit of depreciation deduction over the balance of the service life.

Why the attack on Idaho Power when thousands of other certificates have been issued, not only to utilities, but also to steel, oil, chemical, railroad and many other companies?

Why Attack Idaho Power?

The reason is obvious. The attack is tied directly to controversy over public power groups' demand that the federal government should develop the Snake River site instead of Idaho Power Co.

Congress in the past decided not to authorize the proposed single federal high dam. The Federal Power Commission acted on this by granting Idaho Power a license to build three smaller dams. But supporters of the high federal dam have not given up the fight and have sought every possible means of blocking the company project. The attack on the Idaho Power tax amortization certificates, concurrent with renewed efforts to obtain a high federal dam bill out of Congress, is merely another facet of the fight.

The issue has been underscored in recent weeks by the case of the certificates granted to Idaho Power Co for its three-dam Snake River project (EW, June 24 p 84).

Idaho Power, on April 17, got two certificates, one allowing 60% of the $35.9 million cost of Oxbow, the other allowing 65% of $67.1 million for Brownlee. It first applied for certificates in August, 1953.

"The attack on Idaho Power was politically motivated to

Use of the certificates would permit the company extra tax deductions for five years amounting to about $6 million a year for both dams. This benefit was the same as that granted in 20,821 other cases to railroad, chemical, mining, and other industries (see list below).

The attack on Idaho Power for receiving these certificates was politically motivated and timed to provide ammunition for the Senate debate on the Morse High Hells Canyon Dam bill.

Similarly, Idaho Power's decision to surrender the certificates arose not from the charges and implications of something done illegally but, as Roach said, to put an end to the "beclouding of the issues" involved in the Morse bill debate.

Sen Estes Kefauver (D-Tenn.) chairman of the Anti-Trust and Monopoly Subcommittee, who initiated the investigation into the circumstances surrounding the issuance of the certificates, had by last week piled up the following list of charges. They are:

- That Idaho Power had obtained the certificates by misrepresentation;
- That the company had pressured Administration officials into granting the certificate;
- That it could not meet the completion date of Dec. 31, 1958;
- That someone had profited in Idaho Power share trading through advance knowledge of the issuance of the certificates;
- That a legal opinion from the legislative reference section of the Library of Congress is that the certificates for Idaho Power are contrary to the intent of the amortization law; and
- That Office of Defense Mobilization Chief Gordon Gray refused to surrender a memorandum from his predecessor, Dr Arthur S. Flemming, because Flemming opposed the certificates to Idaho Power.

Kefauver's most important charge politically is the one dealing with the actual benefits to the company and costs to the government of Idaho Power's fast write-off benefits.

This is one of the most confusing aspects of the whole controversy, since there can be no way of arriving at a figure to which all sides would agree. In fact, this uncertainty of the actual cost to the taxpayer is what makes this particular phase of the Hells Canyon fight so politically attractive to the opposition. Federal power proponents can proceed on the basis of the figures they choose, knowing that the general confusion in figures enables them to keep the issue of cost to the taxpayer alive as long as they choose to use it.

Which Figures Are Right?

Kefauver's figures, although they came into his hearing record through testimony of the Federal Power Commission's Chief Accountant, Russell C. Rainwater, are figures that were used by federal power groups long before the hearing began (see Pros and Cons on page 50).

Rainwater's figures claimed that the company would profit, or be given a "subsidy," to the extent of $339 million over the 50-year period

Fast Tax Writeoffs–from the beginning of the program in 1950 through 1956

These industries . . .	Got this many certificates . . .	Which allows these fast tax write-offs . . . (average %)	of these expansion costs (billions)
Electric power*	928	48	$6.7
Railroads	2,458	69	6.3
Primary Metals (75% steel)	1,753	70	5.7
Petroleum & Coal Products	742	62	3.0
Chemical	1,065	56	2.9
Mining	616	70	2.2
Transportation Equipment	2,675	67	1.4
Pipeline Transportation	260	28	1.4
Air Transportation	58	80	1.1
Water Transportation	776	62	.9
Machinery (except electrical)	3,161	63	.8
Pulp, Paper, and Board Mills	117	54	.8
Electrical Equipment, Machinery & Supplies	1,268	62	.6
Ordnance and Accessories	1,143	69	.4
Total (including others)	21,749	61	37.0

Note * as of June 19, 1957.

provide ammunition for Senate debate"

of the FPC license. In the same period, Rainwater said, the certificates would cost the government $83 million.

Idaho Power's Pres. T. E. Roach immediately disagreed with the figures, charging that they had been reached by compounding interest.

If the government did have to borrow money to make up for tax deferrals, Roach said, at the most it would amount to about $16 million over the 50 years, figured at 3½%.

Interior Secretary Fred A. Seaton, who earlier had expressed misgivings about giving the amortization certificates to the company, told Kefauver the cost to the government had been exaggerated. His best information, he said, was that the cumulative cost over 50 years would be about $17 million.

Following the appearance of Idaho Power officials, Kefauver again summoned Gordon Gray, ODM director, to the witness stand. He wanted Gray to produce a memorandum Gray had received about the Idaho Power case from Arthur Flemming, former ODM chief. Gray refused on grounds of executive privilege.

Gray heatedly disputed with Kefauver the implication that the Flemming memorandum expressed opposition to granting the certificates to Idaho Power.

Earlier, in Kefauver's hearing, Sen Joseph O'Mahoney (D-Wyo.) had demanded insistently of Roach that he surrender the certificates—"as a public relations gesture."

In fact, Idaho Power is returning the certificates to ODM—although the company has exercised the option of merely not using them when the time came to submit the tax returns which would be affected.

Roach Rejects Certificates

Roach's action rejecting use of the certificates came as the Senate debate on the Morse bill opened.

The meaning of the Idaho Power move became clear immediately. Democrats opened the fight by charging that Idaho Power was getting a subsidy of $339 million "from the American taxpayers' pocketbook" to build the Snake dams.

Sen Arthur Watkins (R-Utah) retorted that a federal high dam would be a billion-dollar mistake.

The Senate then voted on the bill. By a vote of 45 to 38 it authorized a federal dam at Hells Canyon. The bill is now headed for the House.

Why Fast Writeoffs Were Started

The idea behind fast writeoffs was to spur industry to expand its production capacity and facilities to make strategic goods needed in wartime. Fast writeoffs were used in the U. S. first during World War I, again during World War II. The current program was authorized in 1950, as a result of the Korean fighting, and was extended indefinitely in 1954 by tying it to the continuing Defense Production Act and existing revenue laws.

The current program evolved in the Pentagon—in the case of electric utilities under the old Defense Electric Power Administration—and then was setup under ODM, which was given the authority to approve percentage writeoffs in accordance with mobilization "expansion goals" determined on a basis of mobilization needs. The percentage was set according to a wide variety of individual circumstances and areas of the country.

The electric power expansion goal for generating plants, for example was one of the early ones, 55th on a list of 249, set up in the spring of 1952—after numerous certificates already had been granted under the old DEPA starting the year before. A transmission goal was set later.

The base percentage allowable for fast writeoff of generating plant was 35%, taking into consideration such factors as the hazards of possible over-development, the high costs of financing, construction outlays, and the potential inefficiencies of quickly built plants. However in certain special circumstances certification was allowed up to, but not over, 65% of the total expansion costs.

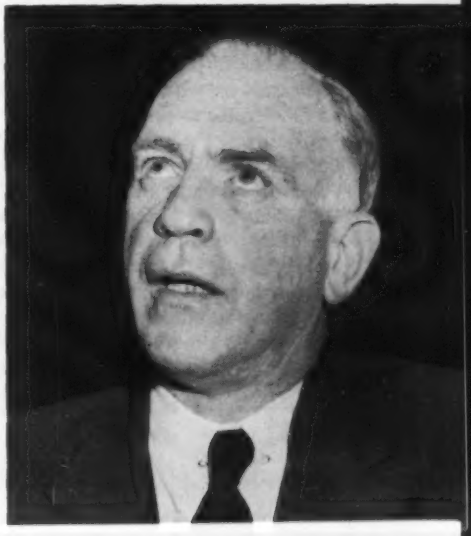
The major argument in the case of electric companies has been over how the deferred taxes should be treated in company books. Should the money be paid out in dividends? Should it go to the company's customers in the form of rate reductions? Should it be retained by the company for construction purposes?

This argument generally has been settled. While the Federal Power Commission has passed no rulings

ROACH: Does his own figuring

KEFAUVER: Stirs cost controversy

GRAY: Won't produce Flemming memo



on electric utilities, however, a number of the state regulatory commissions have ruled on rate-making.

With exceptions, situation is:

Rates: Generally, for the purposes of rate making, the property under the certificate is treated on a conventional straight-line depreciation basis, thus, established rates are not upset.

Taxes: Companies enjoy the lower taxes arising from the greater amortization deductions during the first five years.

Dividends: Tax deferrals from amortization certificates can not be paid out in dividends.

Treatment of Tax Deferrals: FPC has indicated, in a recent gas pipeline case, that such deferrals should be earmarked to provide for future tax liability and the temporary savings should be used to aid in construction of new facilities.

Generally that is how state commissions have ruled. Idaho Power, for instance, at the direction of the Idaho Public Utilities Commission, must place its tax deferrals in a special tax reserve.

Actually, utility customers can benefit from tax amortization. The net effect of such tax certificates is to make funds available to the concerned companies that otherwise would have to go for taxes. So it is money they do not have to borrow. By eliminating the cost of borrowing this money, they eliminate a business expense.

Today the goal for electric power expansion under which the ODM justified the issuance of tax certificates to electric companies is now closed.

But many tax grants will not become effective until two or three years from now—that is, until the new equipment is in place.

The benefits will last for at least another five years beyond that. As long as this is true, electric companies can expect other skirmishes along the federal power front.

Pros and Cons of Fast Tax Writeoffs

Argument becomes abstruse when the two sides—Federal power supporters on the one hand and industry on the other—argue the extent to which tax certificate holders benefit and the government suffers from such certificates. Idaho Power case exemplifies this situation.

Benefit to the Company

FPC's Chief Accountant R. C. Rainwater figured the benefit to Idaho Power Co at $339 million. Previously the National Rural Electric Cooperative Association had used the same figure.

Rainwater justified the figure on these assumptions:

1. That the company would have money equal to the amount of its tax deferment allowed by the certificates—and that its rates would not be lowered to compensate for the fact that lower tax payments might show the company's earnings as running above, say, the 6% normally allowed.

2. That the company would immediately invest the deferred taxes in plant.

3. That the company would be allowed to charge rates that would give it a 6% return on this investment.

4. That the company again would immediately reinvest in plant the first earnings from the tax deferrals on which in turn it would again be allowed a 6% return.

Rainwater admitted that these assumptions would produce a "compounding effect," that is, interest would be compounded annually.

Idaho Power's Pres. T. E. Roach and Sen Arthur Watkins counter that this compounding of interest and earnings is completely erroneous.

Furthermore, they say, the actual benefit to the company amounts only to total interest on money that would otherwise have been borrowed by Idaho Power if the tax deferral was not available.

Cost to the Government

Rainwater figured the cost to the government at $83 million over 50 years. He gave these assumptions:

1. The government would have to borrow money to make up the amount of taxes deferred. Inherent in this assumption is that the government debt would not be paid off during the 50 year period of the license.

2. Present cost of money to the government of 3½%.

3. Present corporate tax rate of 52% will be in effect for the 50 years.

Interior Secretary Fred Seaton, on the other hand, figured the cost to the government at about $17 million over 50 years.

Roach estimated the cost at about $16 million.

The difference again is the method of calculation. Rainwater compounded interest, whereas Seaton and Roach used a simple interest approach.

But the main arguments against the $83 million cost-to-the-government figure are these:

The figures assumes no benefits from the project. Federal taxes, alone, if figured on the same basis as Rainwater used, that compound interest, would total $2.2 billion at the end of 50 years.

The figure assumes that tax revenues pre-exist and are apart from the sources of other business revenues. There is no way to relate arbitrary government debt charges to specific tax deductions.

Watkins charged that if the government built the dam it would cost taxpayers up to $651 million in direct federal appropriations.

In addition, he said, there would be $398 million which would be lost or which will not be reimbursed, if the private company project is terminated. The figure includes federal income taxes, non-reimbursable flood control, and $48 million minimum federal liability to Idaho Power for its investment.

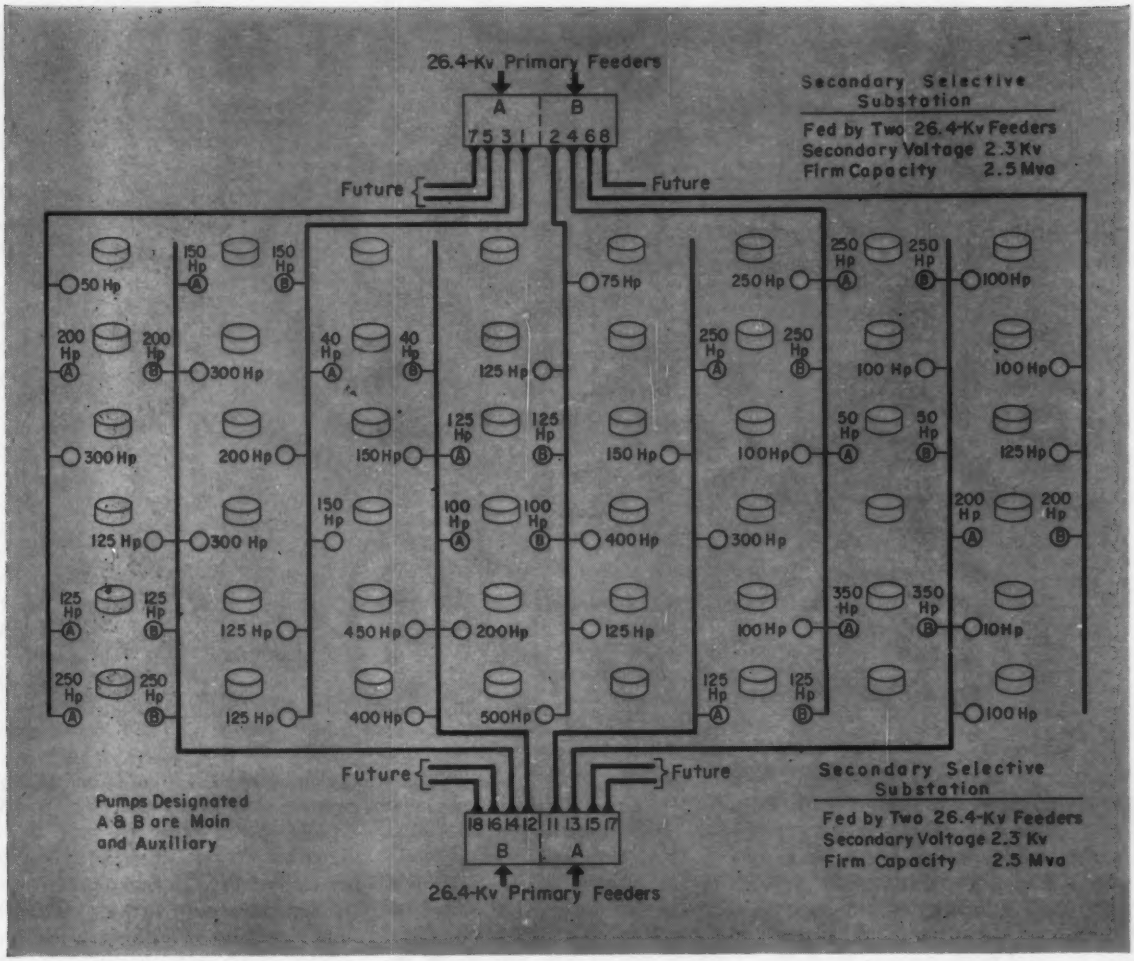


FIG 1—Hypothetical tank field has secondary selective substation at each end. One pair of 26.4-kv feeders serves both. Each tank has two 2,300-v underground feeders available. Secondary, automatic throwover is not shown

2.3-kv Radial Economic for Motors

Composite system has edge over 5 types of distribution for widely scattered 5 to 600-horsepower motor loads. Distribution design must match process reliability exigencies

J. A. **McLELLAN**, Senior Electrical Engineer, Chemical Construction Corp, N. Y., N. Y.

• In establishing or modernizing distribution systems for tank field, well field, or similar widely dispersed 5- to 600-hp single-motor loads, a 2,300-v radial system is advantageous both in terms of reliability and economy when feeder length does not exceed 3,000 ft.

• If necessary, provisions can be made in such a system to power multi-motor loads at an incremental cost below first motor feeder cost.

• Through proper feeder configuration and secondary selective automatic switching, a degree of reliability equal to and consistent with the process needs can be obtained.

• Convenient control can be obtained through leased telephone wires or owner's multi-conductor control cables.

• Cost comparisons of various distribution systems are valid only when complete costs for complete systems are compared; individual motor installations are not comparable.

• To insure proper feed and maximum reliability in a tank or well field, all management and engineering personnel involved must recognize the importance of the electrical distribution system and make provision for it in tank or well field design.

The foregoing conclusions were drawn from the author's survey of the electrical distribution system in a tank field. Purpose of the survey

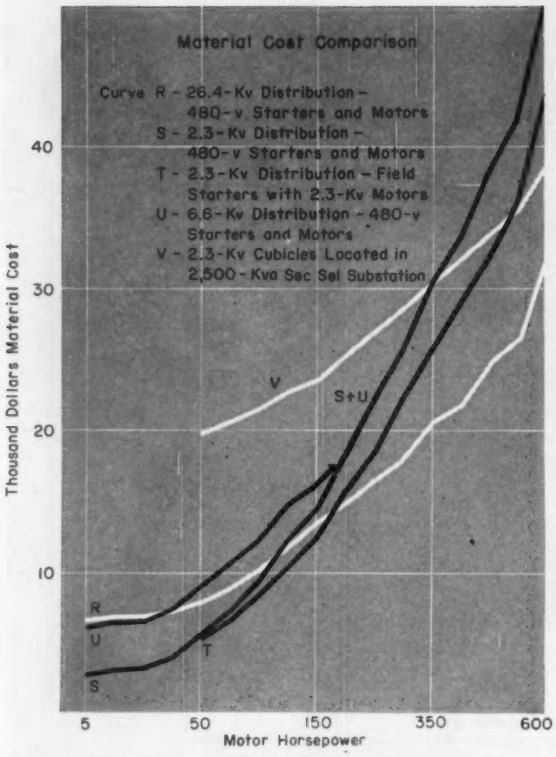

Material Cost Comparison
Curve R - 26.4-Kv Distribution - 480-v Starters and Motors
S - 2.3-Kv Distribution - 480-v Starters and Motors
T - 2.3-Kv Distribution - Field Starters with 2.3-Kv Motors
U - 6.6-Kv Distribution - 480-v Starters and Motors
V - 2.3-Kv Cubicles Located in 2,500-Kva Sec Sel Substation
Thousand Dollars Material Cost
Motor Horsepower
R
U
S
T
V
S+U

FIG 2—Cost of each system includes motors, starters, a portion of feeders, and transformers or substations

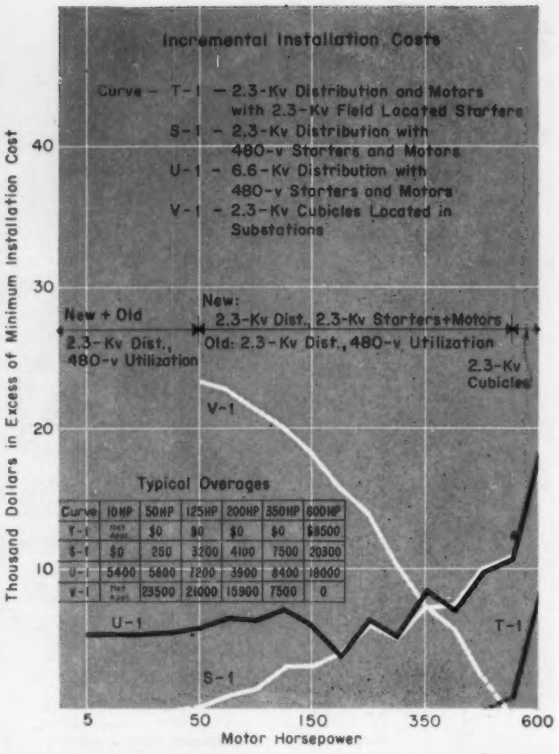

Incremental Installation Costs
Curve - T-1 - 2.3-Kv Distribution and Motors with 2.3-Kv Field Located Starters
S-1 - 2.3-Kv Distribution with 480-v Starters and Motors
U-1 - 6.6-Kv Distribution with 480-v Starters and Motors
V-1 - 2.3-Kv Cubicles Located in Substations
Thousand Dollars in Excess of Minimum Installation Cost
New + Old
2.3-Kv Dist., 480-v Utilization
New: 2.3-Kv Dist., 2.3-Kv Starters+Motors
Old: 2.3-Kv Dist., 480-v Utilization
2.3-Kv Cubicles
V-1
Typical Overages
Curve | 10HP | 50HP | 125HP | 200HP | 350HP | 600HP
T-1 | Not Appl. | $0 | $0 | $0 | $0 | $9500
S-1 | $0 | 250 | 3200 | 4100 | 7500 | 20300
U-1 | 5400 | 5800 | 7200 | 3900 | 8400 | 19000
V-1 | Not Appl. | 23500 | 21000 | 15900 | 7500 | 0
U-1
T-1
S-1
Motor Horsepower

FIG 3—Incremental installation cost is key to design. Number of small motors, safety factors exclude 26.4-kv

was to establish a distribution system whose reliability would match the associated process requirements, and to adapt similtaneously the field to more recent concepts in field pumping requirements.

Five Systems Evaluated

Sensitive material and equipment costs for five different distribution systems were examined. For each system, material costs for 17 different motor sizes, from 5 to 600 hp, were ascertained.

Primary distribution costs were not considered. It was assumed that 26,400-v power was delivered to the tank field substation. Similarly, strictly supply items, such as conduit, wire and cable, concrete substation pads and fencing, as well as labor were assumed to be the same for all cases.

In the distribution system, 480-v motors were fed from 480-v open-wire overhead mains. Pumps above 125-hp were powered from cubicle type starters at the substation.

The five type of tank field distribution evaluated were:

1. 2,300-v underground radial distribution with 2,300-v starters and motors. This type is limited to motors rated above 50 hp because 2,300-v motors are not made in smaller sizes.

2. 2,300-v radial distribution with 2,300/480-v transformers using 480-v motors and starters.

3. 6,600-v radial distribution with 6,600/480-v transformers, using 480-v motors and starters.

4. 26,400-v open-wire aerial distribution, with 26,400/480-v transformers and 480-v motors and starters.

5. 2,300-v cubicles, located at transformer load centers and feeding, through separate feeders, 2,300-v motors at several pump sites. This system is also limited to motors rated above 50 hp.

Flexibility Design Factor

An electrical system whose reliability is below that of the process served will cause expensive production losses; excessive reliability results in undue installation cost and unnecessarily high maintenance requirements. In addition to its reliability requirements, a satisfactory electric system must make provision for changing pump sizes or moving pumps speedily and inexpensively.

Process Changes Occur

The study was based on four principal factors:

1. In contrast with previous practice, recent concepts in refinery processing tend toward feeding large processing units directly from the storage tanks and blending before processing is begun.

2. Existing methods of running open-wire, 480-v mains and powering motor pumps directly at that voltage are considered to be inadequate and obsolete, especially at higher horsepower ratings.

3. In modernizing an electrical distribution system and utilizing a higher distribution voltage, an economical method of converting 480-v pumps to the higher voltage has to be found.

4. Although neat and convenient, the practice of controlling pumps greater than 125 hp from cubicle type substation starters is very expensive. Justification for its continuance is questionable.

The redesigned distribution system sought to use the most economical control method for each motor size while avoiding duplicate systems. Its principal conclusions were:

1. That a 2,300-v radial distribution system be established whereever large pumping capacity is required. These feeders may be either 400-amp rubber insulated, lead covered, armored cable, buried directly in the earth, or self-supporting cables carried on poles. A general plan for these proposed feeders is shown in Fig. 1.

2. That these feeders be controlled, through circuit breakers, from secondary selective transformer stations having a firm capacity of 2,500 kva. Based on its rated kva, each transformer should have an impedance of 8%, as dictated by the fused cutout interrupting ability.

3. That the primary voltage of these transformer substations be 26,400 v, fed directly over a cable pair from the purchased power switching station. All cost estimates are based on such an installation.

4. That for new motor pumps between 5 and 50 hp, taps should be made from the 2,300-v feeders through properly sized, oil-immersed fused cutouts, to 2,300/480-v stepdown transformers which, in turn, would feed the motor starters controlling the 480-v motor pumps.

5. That for new motor pumps between 50 and 450 hp, taps should be made from the 2,300-v feeders through oil-immersed, fused cutouts, to 2,300-v oil-immersed starters controlling these 2,300-v motor pumps.

6. That for motors in excess of 500 hp, the motor pumps should be controlled by 2,300-v cubicles at the substation.

7. That in no case should more than 20 motors be on any 2,300-v radial feeder. Feeder ampere capacity and motor sizes may even reduce the maximum permissible number below 20.

8. That all radially fed motors should be equipped with phase reversal relays to detect single phasing caused by a single fuse blowing and damaging a motor.

9. That existing motor pumps rated below 500 hp be maintained as they are, with appropriately sized transformers and 2,300-v fused cutouts on the high-voltage side. Thus 480-v motors should have an appropriately sized, fuse-cutout protected, 2,300/480-v transformer ahead of them. Existing 2,300-v motors would simply have a fuse-protected field starter installed just ahead of them.

10. That the 2,300-v radial feeders be run in such a manner that adjacent rows are fed from separate transformer banks. This system provides for feeding main and auxiliary pumps not only from separate transformers but also from different primary feeders and thus

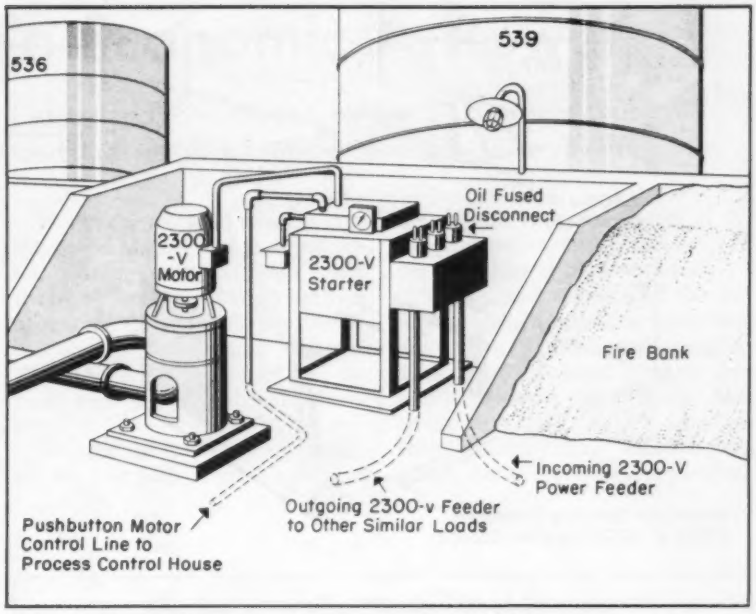


FIG 4—2,300-v distribution with 2,300-v motors and field-located starters is most economical between 50 and 450 hp. Pushbutton line permits remote operation

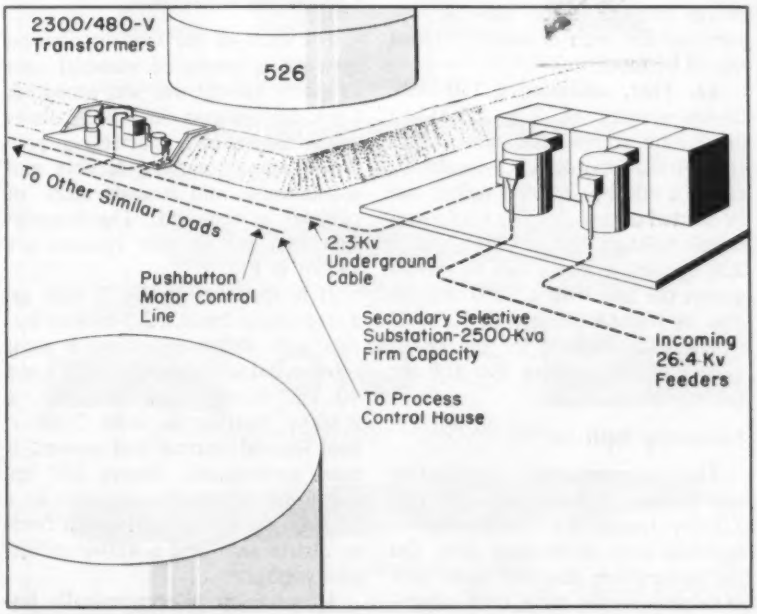
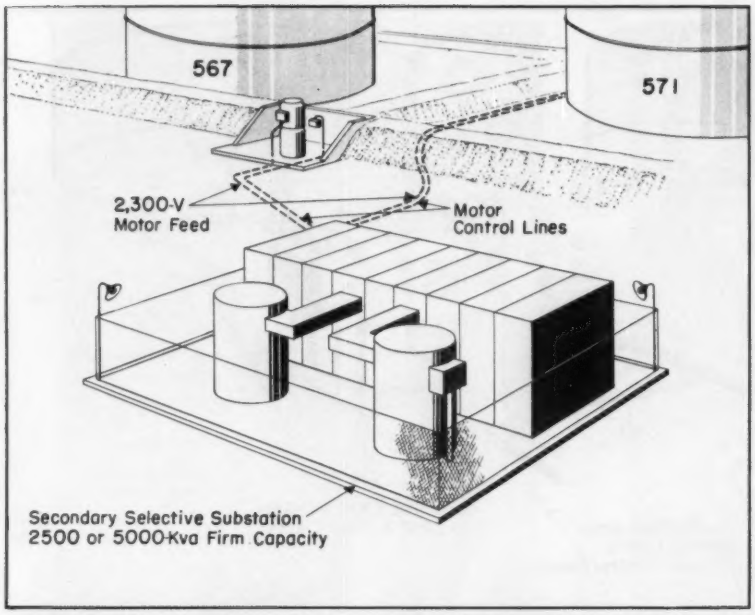


FIG 5—2,300-v distribution, 480-v, utilization is used below 50 hp. Oil fused disconnects on high side of transformer provide protection



MOTOR PUMPS larger than 500 hp are controlled by cubicles located at the substation. Cubicle control is uneconomical for smaller motors

assures a maximum degree of pumping reliability.

11. That a control wire system using either leased telephone lines complete with pushbuttons, relays, and battery power or control cables installed by plant electrical forces, be put in to control those pumps requiring remote control. Since existing cubicle installations use stop-button circuits between the pump and the starter site the cost increase for such a control system would be moderate.

12. That, assuming a 250-Mva, 26-kv system, an 8% 2,500-kva 26/2.3-kv transformer, and 3,000 ft of 4/0, 3-kv, RINJ 3-conductor cable, a 600-hp, 2,300-v motor can be started across the line with a terminal voltage dip of 22%, or a 200-hp, 480-v motor can be started across the line with a 21% voltage dip. A NEMA Design B, C, or D motor was assumed for the latter, and a 650% starting kva for the 600-hp motor.

Reliability Built In

The recommended distribution system would have two 26,400/2,300-v transformer substations at opposite ends of the tank field. On the assumption that the same pair of feeders would serve both substations, all distribution feeders from transmission feeder A are odd numbers, those from B even numbers. Thus each tank has readily available two underground, 2,300-v feeders which jointly can supply reliable power either to duplicate motor pumps or to single pumps. Not shown is an automatic secondary throwover scheme to provide two supplies for either of two pumps if necessary.

Cost vs Hp Calculated

For each of the five distribution systems, a graph of material cost vs motor horsepower was prepared. Cost calculations included allowances for motors, starters, a proportionate amount of feeders and substations, and transformers or cubicles as required. The cumulative data for all five systems are shown in Fig. 2.

It is apparent in Fig. 2 that, on a free choice basis, a 2.3-kv distribution with 480-v utilization is most economical for motors between 5 and 40 hp. From 50 to 150 hp, a 2,300-v distribution with 2,300-v, field located starters and motors, is most economical. Above 150 hp, the least expensive system is a 26.4-kv open overhead radial feeder distribution and a 480-v utilization voltage.

However, it is economically impractical to have both a 26.4-kv overhead system and a 2.3-kv underground system in the same tank field. In addition, the installation costs for small-horsepower motors on a 26.4-kv primary are high and there are aesthetic and safety objections to overhead open-wire feeders. After comparing the penalties involved in not using 26.4-kv above 200 hp with those incurred in using it below 200 hp, it was decided to discard this system.

Curves Include Labor Cost

Incremental installation cost calculations, showing the overages incurred in not using the least economical of the four remaining voltages were then plotted as shown in Fig. 3. To provide realistic curves useful to management, it was arbitrarily assumed that for any given installation, material would constitute 60% of the cost and labor 40%. Therefore, Fig. 3 includes a labor component and is a realistic index of the excessive costs accrued in using an uneconomical design.

In considering labor as a constant, it was assumed that labor practices for 2,300 and 6,600-v installations being very similar would not create any significant difference in costs as indicated above.

In the 500 and 600-hp pumps using cubicle starters, sufficient short-circuit protection can be obtained by using special fuses in the individual cubicles. However, in the case of motors between 5 and 450 hp, operating from a radial feeder, protection is complicated by the impracticability of protecting a large number of different sized transformers and motors against short circuits from the breaker relays.

As a minimum, the equipment chosen must be suitable for use in Class I, Group D, Division 2 areas, the category into which tank fields fall. However, commercially available fused cutouts, when used with a muffler in the proper type of subway construction, will permit the motors to start through a reasonable acceleration period and still provide satisfactory protection. In selecting protective equipment, the 80% acceleration point is used as an approximation of the time at which starting current declines to running current.

The primary fusing must also protect the transformer against secondary faults.

Fuel Is Key To Economic A-Power

But more research and experience are needed before fuel elements can be designed to withstand the rough treatment they get in a reactor

Many nuclear experts believe that the fuel element is the key to economic and cheap nuclear power. Nuclear power plant investment costs are high of course but there is ample evidence to indicate that they will be reduced as experience is gained and a larger market allows repetitive manufacture. Even so, few people believe it will be possible ever to reduce capital costs substantially below those of today's conventional plants.

On the other hand, the potential savings possible with improved fuel technology are overwhelming. Theoretically there is about 2½ million times as much energy in a pound of uranium as there is in one of coal. Yet with today's technology only about 1% of nuclear fuel is consumed in a reactor before it must be removed for re-processing.

This necessity is due to the rugged treatment the fuel elements receive in the reactor. Heat transfer requirements alone are staggering. In addition to this, distortion resulting from irradiation adds to the fuel element designers' problems. These and other problems are attacked today on a broad front.

Here is the present status of the technology and research programs.

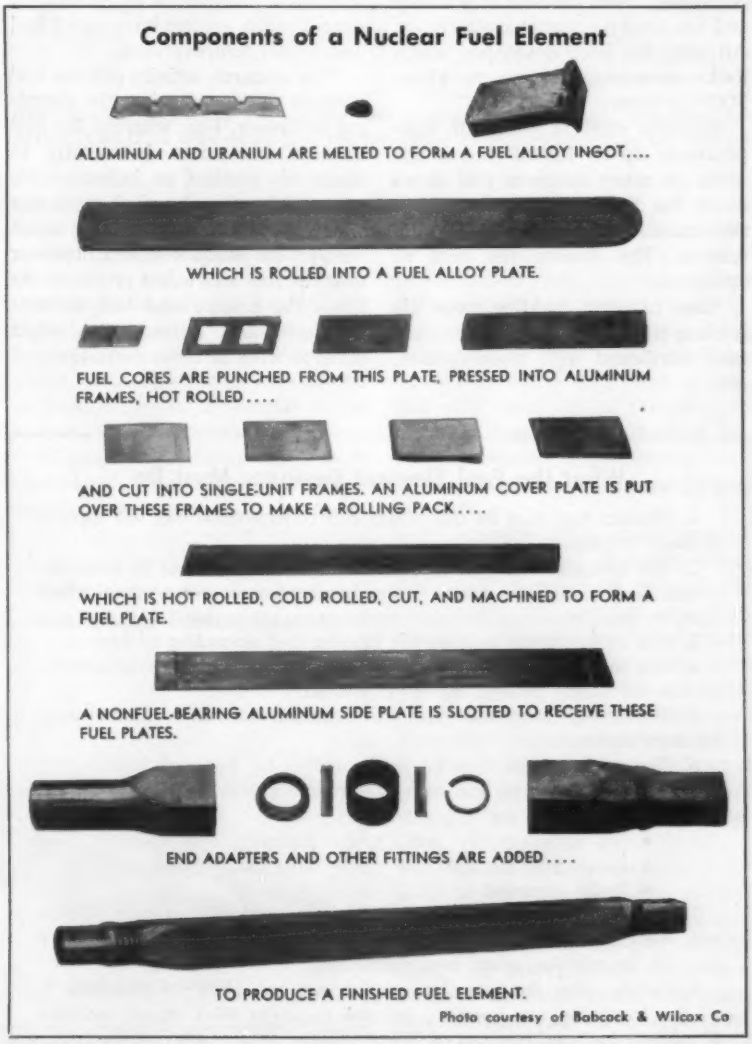
Fuel elements vary in shape, size, and makeup according to the type of reactor. Generally, though, the element can be regarded as a long, thin, hollow structure, perhaps tubular, square, or hexagonal in shape, about 4 to 6 ft long, and about 4 to 6 in. in dia. A number of fuel elements assembled in a specific shape make up the reactor core.

Core shape is dictated primarily by five factors: **1.** A geometrical pattern that gives the maximum amount of fissioning for the available fuel; **2.** A shape that gives the maximum surface exposure to the coolant within the core so that heat is carried away quickly; **3.** A shape that facilitates loading and unloading of fuel elements; **4.** A shape that assists in control of the fission process; and **5.** A shape that assures containment of fission products.

Each tube-like fuel element contains solid nuclear fuel in either pellets, plates, rods, or some other shape, depending again on the type of reactor. In this shape the fuel itself is clad with suitable material. The structural material of the element itself provides the final cladding.

Because the fuel element contains the nuclear fuel, it must withstand the greatest heat and impact of the fission process. This is the heart of the fuel element bottleneck today.

The materials that hold the element together (cladding materials) are unable to withstand temperatures beyond a certain point, as they also break down under fission. Materials that can take high temperatures generally have shortcomings which outweigh their temperature


Components of a Nuclear Fuel Element
ALUMINUM AND URANIUM ARE MELTED TO FORM A FUEL ALLOY INGOT....
WHICH IS ROLLED INTO A FUEL ALLOY PLATE.
FUEL CORES ARE PUNCHED FROM THIS PLATE, PRESSED INTO ALUMINUM FRAMES, HOT ROLLED....
AND CUT INTO SINGLE-UNIT FRAMES. AN ALUMINUM COVER PLATE IS PUT OVER THESE FRAMES TO MAKE A ROLLING PACK....
WHICH IS HOT ROLLED, COLD ROLLED, CUT, AND MACHINED TO FORM A FUEL PLATE.
A NONFUEL-BEARING ALUMINUM SIDE PLATE IS SLOTTED TO RECEIVE THESE FUEL PLATES.
END ADAPTERS AND OTHER FITTINGS ARE ADDED....
TO PRODUCE A FINISHED FUEL ELEMENT.
Photo courtesy of Babcock & Wilcox Co

PRODUCTION OF fuel elements for Materials Testing Reactor or other reactors involves complex processes of melting, alloying, brazing, machining, and welding

resistance characteristics.

Nuclear fuel elements so far have been made mostly with such cladding materials as zirconium, aluminum, and stainless steel.

Zirconium was originally considered as a cladding material because for reactor construction it has one very desirable property—it absorbs very few neutrons (low neutron absorption cross-section) and therefore does not slow down the fission process. But zirconium corrodes rapidly in water beyond 700F. However, a crash research program has produced a zirconium alloy affording better resistance to corrosion and took temperature resistance up to 900F in steam.

Has Good Nuclear Properties

Aluminum is another material commonly used because it is cheap and has good nuclear characteristics. An alloy has been developed which looks promising for up to about 500F in water.

Stainless steel is good for temperatures up to 1,500F but it absorbs so many neutrons and slows down the fission process so much that extra fuel must be added to the reactor. This boosts the cost of operation.

None of these cladding materials is close to being ideal because they can't withstand high temperatures, corrode too rapidly, or have other weaknesses. Because of these deficiencies, a fuel element's life is short. It must be replaced before all the nuclear fuel is consumed. In fact, today only about 1% of nuclear fuel in a given element is consumed before the element has to be pulled out, although the fission process can develop temperatures in the millions of degrees.

Inadequacy of fuel element materials means that atomic power plants can't operate anywhere near the high temperatures essential for efficient electric power plant operation. Without resort to separately fired superheaters, the maximum steam temperature of the nuclear power plants now proposed is about 825F.

But new alloys are being developed that promise improved performance. And use of ceramics may permit much greater burn-up of fuel and higher temperatures.

This research activity pits the fuel element designer against the chemical processor. For, whereas the fuel element researcher is striving to make his product as indestructible as possible, the chemical processor wants something he can take apart without too much trouble to recover unspent fuel and waste products. At times the reactor and fuel element designers and reprocessors might seem to work at cross purposes.

What the Fuel Element Designer Must Do

1. Nuclear fuel must be assembled in a configuration that will support a chain reaction.
2. The fuel itself must be prepared in such a manner as to resist distortion and breakdown under fission bombardment and encased effectively to prevent escape of fission (radioactive) products.
3. The configuration must permit loading and unloading of fuel.
4. The configuration must permit introduction and removal of controls so that the fission process can be regulated.
5. The configuration must permit the coolant material to flow through for heat removal.
6. This configuration must be held together by materials that:
   - Don't soak up too many neutrons and thereby slow down the fission process.
   - Are dimensionally stable under radiation and heat.
   - Retain their strength over a very wide temperature range.
   - Resist corrosion.
7. Within the configuration, the fuel must be protected from contact with the coolant by materials which have all the qualities listed in 6 and are, in addition, good heat conductors.
8. Finally, after the fuel element designer has given consideration to all the foregoing requirements, he can begin to think about recovery of unspent fuel and removal of fission poisons.

The variety of cladding or alloying materials in fuel elements is a real headache to the chemical processor. Of all the materials used today, the only one for which an extensive processing technology exists is aluminum. With other materials, processing technology is in varying stages of development.

One, perhaps the major, reason for the conflict between the interests of the fuel element designer and the chemical processor is that the former must cope with a long list of requirements before he can even begin to think of the chemical processor's needs (see box below).

Recovery of unspent fuel and removal of fission poisons make a completely different reactor design, the homogeneous reactor, attractive. In this reactor, the fuel element as such is eliminated and the atomic fuel is dissolved in the coolant in the form of a water-acid solution or in a liquid metal—a sort of slurry.

The fuel only attains critical mass in the reactor where fission takes place. The resultant heat energy is carried by the circulating piping to an external heat exchanger.

Not Without Problems

But homogeneous reactor has to have continuous, on-site, chemical reprocessing of the fuel solution. This is one of the major objections to this type of reactor. Its use would put a utility in the chemical reprocessing business. And the corrosion problems associated with this type reactor are tough to lick.

There are other factors imposed on materials requirements by yet other reactor variants but the foregoing are the prime considerations.

Fuel-element-materials research today falls into two broad categories: Improving existing materials and finding new material.

In the first category this is what is being done:

- Zirconium research centers on two major aspects, improving performance and cutting costs. As indicated previously, zirconium is desirable for reactor use as a cladding and alloying material because of its extremely low neutron-absorption cross-section. But it has temperature and corrosion limitations and is still too expensive.

Work is being done on Zr-based alloys with the objectives of developing greater structural strength

under high temperatures and improving temperature and corrosion resistance. And there is research underway to improve techniques of fabricating Zr in different shapes and in methods of production to cut costs.

The problem of costs is being attacked by seeking cheaper ways to extract the metal from the ores. One of the principle problems is the fact that zirconium always occurs in the natural state with hafnium—an element that has such a great affinity for neutrons that it is used as control rod material. Thus the chemical engineer must provide an extremely pure grade of zirconium—a task quite costly and difficult because both zirconium and hafnium have almost identical chemical properties and are difficult to separate chemically.

• Aluminum research also explores alloying possibilities for improving performance. An alloy containing small quantities of nickel has produced considerably improved corrosion resistance in hot water. Chief attraction of aluminum for reactors is its low cost and a fairly low neutron absorption cross-section.

On the other hand, it has considerably lower temperature and corrosion resistance than Zr.

• Stainless steel technology has been fully developed and little is being done in the way of further research for atomic purposes. Because of its high neutron absorption cross-section the Atomic Energy Commission does not expect that any significant quantities of stainless steel will ever go into the reactors themselves.

• Beryllium, although it has highly desirable properties including a low neutron cross-section, is extremely costly. This has put it outside the immediate sphere of interest as far as research is concerned.

Magnesium is being used as a cladding material in British reactors but there is no interest in this material in this country and consequently no AEC research. It has a smaller cross-section than aluminum. But the major objection from the U. S. point of view is its low melting point. In addition, the metal corrodes rapidly in water, and there is considerable emphasis in this country on water reactors. Its corrosion resistant however is excellent in carbon dioxide, the coolant the British are using.

• Ceramics offer much promise for improving fuel elements. Practically all fuel-element research facilities are working today on ceramics or cermets—the latter being combinations of ceramics and metals. Aluminum oxide, graphite, silicon carbide, uranium oxide—almost any oxide—provide materials for work in this field. But again there are limiting factors, chief of which is the rate of neutron absorption.

Ceramics appear to be particularly suitable for power reactors as they can withstand high temperatures and thus increase the thermal efficiency of power plants. Combinations of uranium oxide with other ceramic materials have reportedly given promise of greater burnup of

(*Continued on page 95*)

Fuel Element Subassembly for Materials Testing Reactor

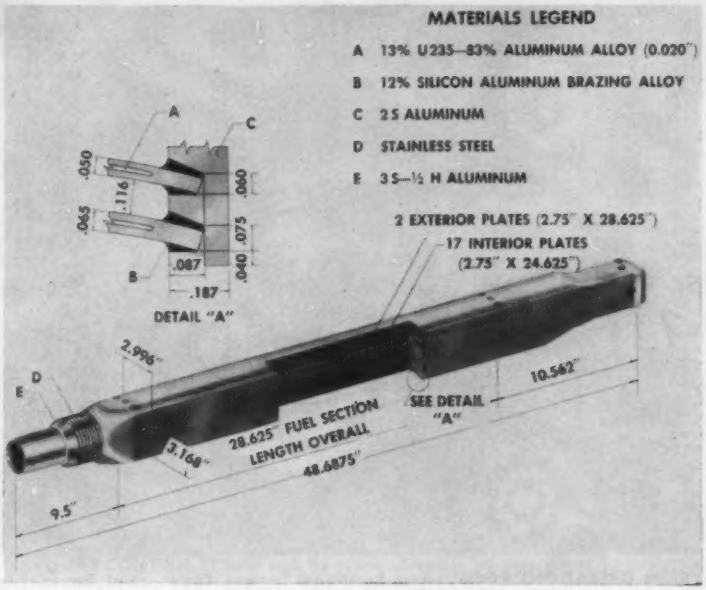


Photo courtesy of Babcock & Wilcox Co

THIN PLATES containing the nuclear fuel is one type of design. Whatever the design it must be such as to give the maximum surface exposure to the coolant

Cutaway of Fuel Element for Consolidated Edison Reactor

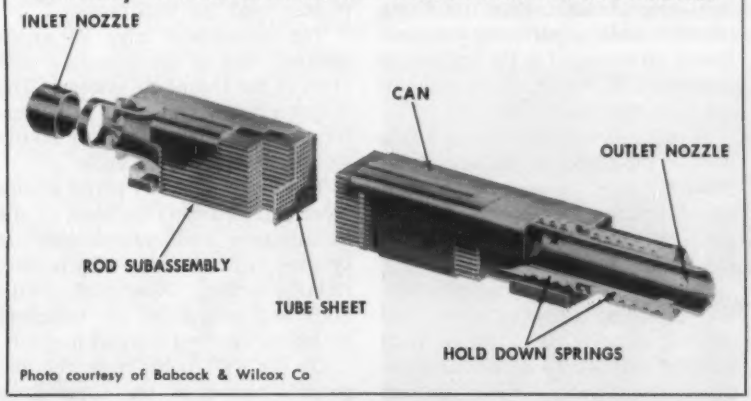
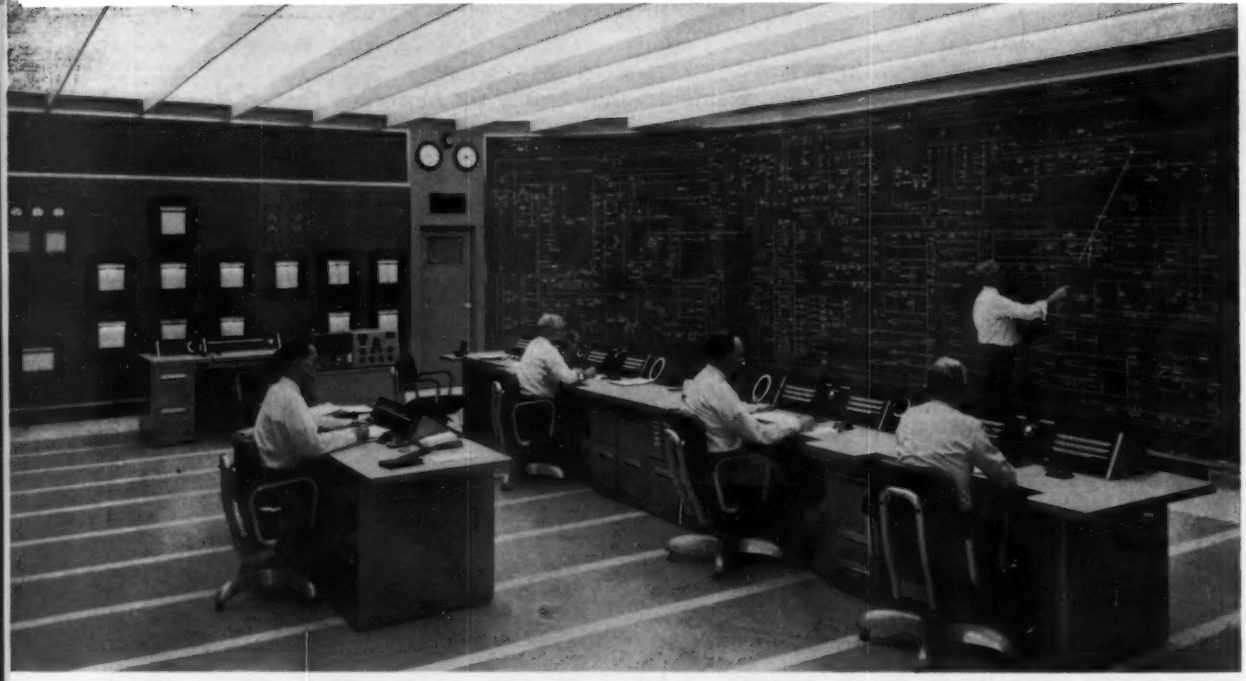


Photo courtesy of Babcock & Wilcox Co

FUEL ELEMENTS can be composed of small rod subassemblies held in place by tube sheets and outer cover. Coolant flows within assembly to remove heat produced



SYSTEM OPERATIONS ROOM offers functional lay-out. Load-totalizing board (left), system map (center), supervisory control board (right, not shown) can be studied from shift supervisor's desk and special four-man dispatchers desk

New Dispatch Center Ups Efficiency

SYSTEM ENGINEERING
OPERATION

Operation proves merits of center designed for centralized control of all Duquesne Light's system dispatch functions

W. C. BRYSON, General Superintendent, System Operations & Load Dispatching Department, Duquesne Light Co, Pittsburgh, Pa.

A new system dispatch center is rewarding Duquesne Light Co with increased efficiency in equipment and personnel. Four months of operation have proved the many intangible benefits derived from improved function grouping and a better operating atmosphere.

The Duquesne system, comprising about 817 sq miles with high load density, is ideal for application of control at one point. Three major system characteristics dictated a choice of centralized control at the new dispatch center: (1) an efficient and extensive private communication system serving operational needs, (2) close grouping of power plants, bulk power transmission, and step-down substations, and (3) a concentrated service area.

For these reasons the new center was designed with centralized control for all system dispatch functions, beginning with power stations and following through all voltage levels to the distribution system.

Effective dispatching requires that facilities be arranged for full utilization, and this was a primary consideration in the layout. Three functional areas are provided so that the facilities unique to each area can be used effectively. These are the system map board, load totalizing board, and supervisory control board, all arranged in the operations control room within visual range of the shift supervisor's desk.

A specially designed four-position desk in the center of the operations control room permits supervision and direction of all switching. Two positions are operated normally; all can be manned in emergency.

New recessed telephone turrets and matching two-way radio and control consoles in front of each position provide basic communication. The turrets, designed by Bell Telephone Co for this specific application, are cord-ending type with 120 terminals. They can be expanded to 160 terminals.

The company's privately owned wire facilities can be interconnected with those of Bell by contractual agreement. Main points of communication are the five power plants, automatic and attended substations, T&D operating districts, work dispatchers, company PBX, automatic phones, and the Bell system.

The dispatchers have an unobstructed view of the schematic diagram of the Duquesne system. The diagram board, consisting of 12 perforated steel sheets, forms a 10-by-48-ft wall with curved ends.

The diagram shows major equipment and switching facilities of the transmission and sub-transmission systems in accordance with normal running order. Abnormal conditions and clearances are indicated by plastic-covered colored magnets.

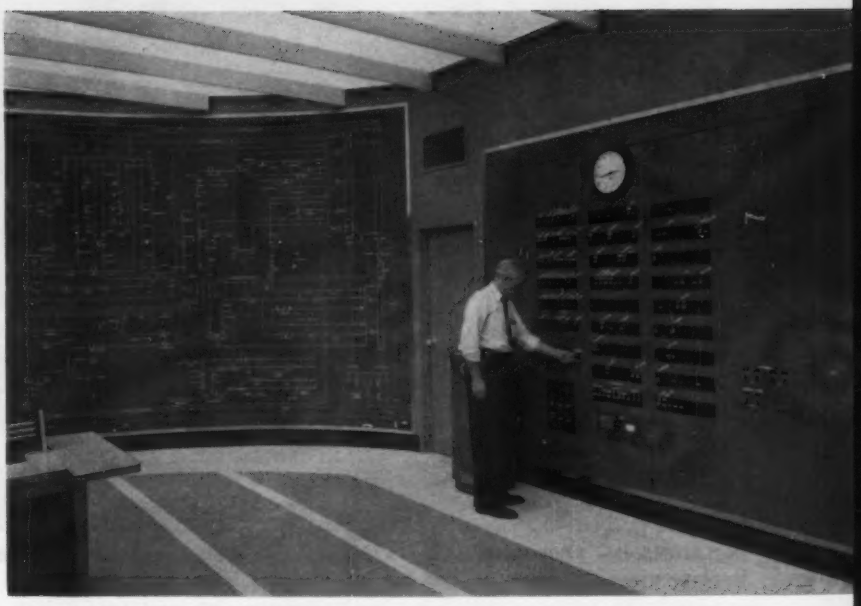
On the wall to his right, the dispatcher can scan the supervisory control board to determine the condition of various key stations. De-

tailed information is at his finger tips in records, diagrams, manuals, and charts in the desks.

On the other side of the room, generation is controlled from a position facing the load totalizing board. The dispatcher has 20 key-ending terminations directly to power station control rooms, dispatch centers at interconnected companies, selected bulk-power substations, the Bell system, and company PBX. A load control console shows generating station limits and permits setting of tie line schedules and frequency bias.

A wall of recorders in front of the desk shows how total system load is supplied from generating sources. Blinking red, green, and amber lights show transmission of regulating impulses which control power generation according to the economic loading schedule.

Additional recorders give frequency, deviation, increment cost, and several large customers' loads. Still other instruments give system electrical characteristics.



SUPERVISORY CONTROL BOARD can be scanned easily by dispatcher to determine condition of various key stations. Relay equipment room is behind this board

Supervisor Has Central Post

From a central position in the room, the shift supervisor can coordinate the work of all dispatchers. His position has a telephone turret essentially the same as the one for directing loading. The weather-reporting teletype, barometer, humidity and temperature recorder are close by for load forecasting.

Directly behind the supervisory control board, all relays and communications terminations for dispatching purposes are installed in the relay equipment room. The room can accommodate complete supervisory and remote control for various major substations and tone equipment for load control and telemetering. Network protector supervisory equipment of the downtown 11-kv network is also installed here. Relays, instruments, recorders, and radio equipment can be repaired in an adjacent workshop.

Power for the dispatch center and auxiliaries is normally provided from the 208/110-v downtown network. Emergency is supplied from a 4-kv distribution feeder via automatic throwover. If both services are lost, a gas-driven generator can supply selected lights and power.

To the rear of the dispatch room is the general office space. A window in the conference room directly behind the supervisor's desk permits observation by visitors.

Total area occupied by the system operations and load dispatching department is about 5,000 sq ft, all air conditioned. Twenty-four-hr air conditioning is guaranteed by two different systems, separate from the general building unit.

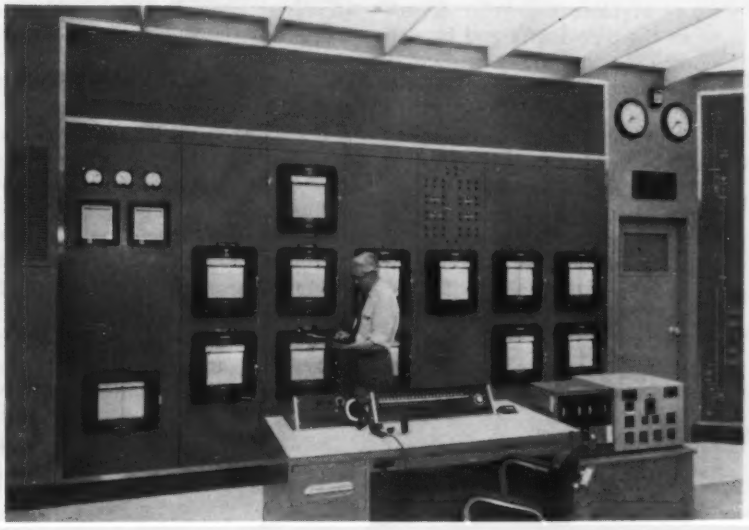
Fluorescent lamps provide a high level of illumination, and a white plastic material diffuses a solid ceiling of light above the dispatch area.

During the move from the old to the new center—the third to eight floor—24-hr operation was maintained by temporarily duplicating essential facilities such as radio, recorders, supervisory signals.

New facilities were paralleled with similar existing ones at the old location by utilizing a telephone tie cable. Except for less essential load recorders, most that were to be moved were installed at the new location and replaced temporarily with older types. Records were then re-transmitted to the temporary recorders during the changeover.

On the actual cutover, system generation was controlled for two 1-hr periods by the stand-by scheme at a generating station.

LOAD TOTALIZING BOARD shows generation, frequency, deviation, increment cost, and other data. Generation is controlled from position facing the board



INSTALLING this 2,000-MCM copper 132-kv pipe-type cable in close triangular formation and burying the pipe in a medium of high thermal conductivity enabled Public Service E&G to get an extra 35 Mva from the 190-Mva rating

Pipe Cable Gains Extra 35 Mva

TRANSMISSION
Design

Added capacity from 190-Mva-rated cable more than offsets cost of research and special Public Service installation

J. A. PULSFORD, Distribution Plant Engineer, Public Service Electric & Gas Co, Newark, N. J.

An extra 35-Mva capacity will be derived from a 2,000-MCM 132-kv pipe cable by Public Service Electric & Gas Co. This gain over the conventional 190-Mva summer rating more than offsets the extra cost of the research and special installation that was required to get it.

Public Service hopes to gain this capacity by installing the cable conductors in close triangular formation to cut pipe losses and by surrounding the pipe with a medium of highest practicable thermal conductivity.

Heretofore, load requirements of specific cables have been too low to justify this added expense. Consequently, the industry knew neither the actual cost of a line rated for maximum theoretical output nor how to achieve this end.

Public Service faced these unknowns last year as it prepared to construct a 20-mi line from its new Linden Station to West Orange Substation. Two-thirds of this line had to be cable. It was required that this cable have a continuous summer rating of at least 225 Mva.

A double line could not be justified on the basis of cost or reliability. It would cost about $110 per ft, compared with $60 for a single line, and would add $3,000,000 to the project's cost. A single line could be expected to have not more than 6% of the number of outage hours of its associated generator.

Special Treatment Ups Rating

With de-rating for all unknowns of soil thermal conductivity and the configuration of the cable in the pipe, a 2,000-MCM cable could be built having a continuous summer rating of 190 Mva. Eliminating these unknowns, however, and installing the cable in close triangular formation and the pipe in a medium of high thermal conductivity would increase the rating to the desired 225 Mva.

In this particular instance the cost of research and a substantial premium on cable installation cost was justified. The suggestion that a high density sand be used, along with methods for computing its thermal correction, was proposed by Philadelphia Electric engineers. This work was extended in an investigation of soil and backfill characteristics on experimental pipes buried adjacent to the proposed cable route.

The following basic design was then established:

1. Cable size: 2,000-MCM copper.

2. Encase the entire length of the pipe in high thermal conductivity sand (Fig. 1).

3. Increase trench width and depth to permit greater cross-sectional area of thermal sand in areas of low soil thermal conductivity (Fig. 2).

The rating of the line is based on an equivalent soil resistivity of 66 w-cm units. The soil was tested by the needle technique at 1,000-ft intervals along the proposed route. Soil density and moisture content measurements were made at intermediate points.

Where the soil needle test indi-

cated greater than 80 w-cm units or density was less than 95 lb per cu ft, the wide trench was specified. Approximately 37% of the line required wide trench.

Sand imported for backfill has a thermal resistance of about 40 w-cm units with normal moisture content. Its moisture retention is excellent, but tests indicate that it may dry out during prolonged dry heat waves. It may be necessary to de-rate the cable during such weather conditions.

4. Oscillate the oil content of the line to disperse hot spots.

Wide variations of soil thermal conductivity are known to occur within short distances. Because it is impracticable to make enough measurements to locate all possible future hot spots from this source, this "hydro oscillating" cable was developed to remove any local rating limitation that might otherwise have to be imposed.

Pumping plants at the cable terminals were designed to oscillate the oil content of the line. This feature causes oil retaining too much heat at a hot spot to be moved periodically to a point where that heat could be dissipated into an environment of higher thermal conductivity.

5. To cut losses to a minimum, tie the cable with nylon tape in triangular formation as it is drawn in the pipe.

A number of construction problems resulted from these novel specifications imposed by the designing engineers.

Bring In High-Density Sand

First, a high-density quartz sand had to be found. After measuring thermal conductivity along the line route, engineers went to the sand dunes of South Jersey with their measuring devices. They finally found a sand with proper proportions of fine, medium, and coarse grains to provide maximum practicable density, with a small percentage of kaolinite clay to aid moisture retention. The sand could be obtained from a supplier who mixed sand from two naturally occurring sands.

The sand was shipped in hopper-bottom coal cars, but it had to be unloaded by clam-shell bucket. Apparently, the mixture of complementary grain sizes and moisture retained by the clay locked the sand mass together under influence of vibration in transit.

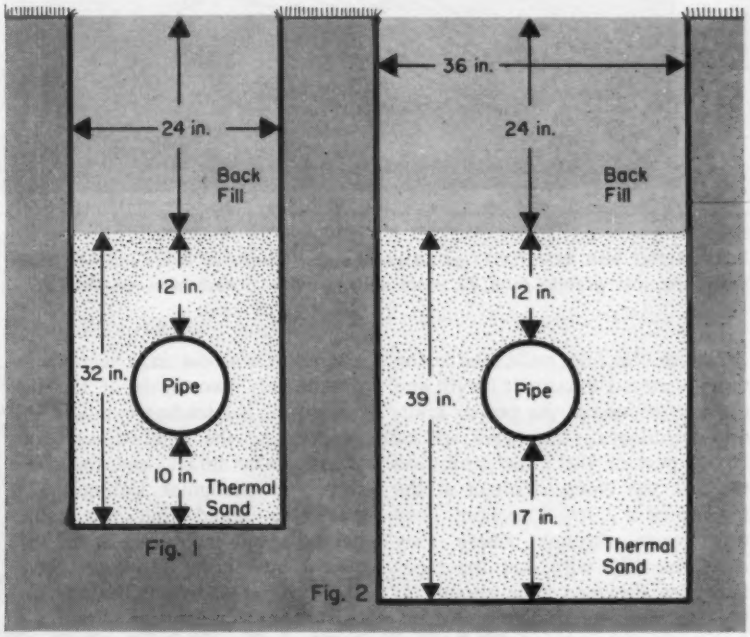
The first thought was that the sand should be compacted in the trench by vibration. But, it was learned from others that this method tended to destroy the homogeneity of the mixture. Consequently, mechanical tampers were adopted.

The special sand cost about $6.00 per ton in place. The increased cost of the line resulting from thermal backfill, extra trench width, and disposing of excess soil was about $3.00 per ft.

Engineers have long talked about ways of keeping cable in pipe in triangular formation. From electrical tests on an earlier line they were satisfied that 2,000-MCM cable in 8⅝-in. pipe would rest generally in cradle formation and have a poor ac resistance. Continuous binding under load changes would force the three cables to snake together rather than bird cage, with the probable consequence of dangerous thrusts at connectors and on sidewalls of the pipe at bends.

Furthermore, a break, as by wearing through, in a continuous binding would release the binding over many feet and permit the cable to relax into cradle formation. For these reasons, spaced individual ties were adopted. After a study of many materials, nylon tape was selected as most practical.

CABLE was tied with nylon tape in triangular formation to cut losses

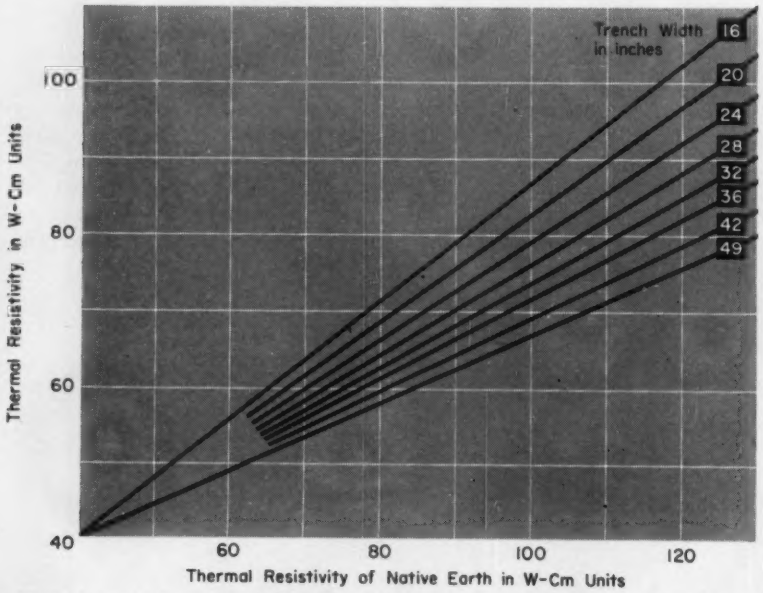


ENTIRE LENGTH of pipe was buried in high thermal conductivity sand (Fig 1). Wider, deeper trench (Fig 2) was used where soil had low thermal conductivity

HIGH-DENSITY quartz sand was found after extensive research and supplied by mixing naturally occurring sands

16-IN. SLEEVE under highway will receive the 8⅝-in. pipe for the Public Service Electric & Gas Co cable

CABLE was buried in trench in park road shoulder. Overhead construction was not acceptable in the park



EQUIVALENT SOIL RESISTIVITY of 66 w-cm units is basis of line's rating. Where resistivity was greater than 80 w-cm units, a wider trench was specified

Before the first pulls, the nylon tapes were cut to correct length and the men trained in the proper knotting techniques. Ties were spaced 25 ft apart on the initial pull, and the first ties emerged intact at the far end of a 2,700-ft section. They were worn through where they cross the "D" wire, but the tapes had been designed wide enough to hold the tie intact. The space between ties was reduced to 15 ft.

To afford additional information a window was cut in a section approximately two-thirds of the distance from the feeding manhole. All ties passing the window were observed to be intact, and the cable stayed in triangular formation. It was also noted that the cables twisted about each other at the rate of one revolution for each 75 to 100 ft and individual conductors twisted at at undetermined rate.

Information obtained at this window was so valuable that a second was cut at the midpoint of another section. This time the window was a few hundred ft on the pulling side of a 60-deg, 85-ft radius bend. The cable was marked at every tie and half way between ties to permit determination of both cabling and conductor twist.

The information derived at the first window was verified at the second. However there was much less twist at the second, which was closer to the feeding end. Part of the cable, just after rounding the bend, passed the window in semicradle formation, the nylon ties having stretched. There was some indication that the cable might all return to triangular formation when the pulling tension was relaxed.

The tying operation, if 100% successful, would increase the rating of the line by about 9 Mva. While there remains some uncertainty of its success, its cost is negligible.

Construction of this maximum-rated cable has indicated that there are no insurmountable difficulties. From the experience of building this line it is concluded that it is somewhat like buying "a pig in a poke" to build a pipe cable in an environment of unknown thermal resistance, or to build a line where the relationship of the conductors within the pipe is unknown. If specific ratings approach the theoretical maximum, careful engineering will produce the desired results.

NOW: From General Electric's
Regulator Engineers:
A Chart Designed To Help You . . .

COMPARE REGULATORS

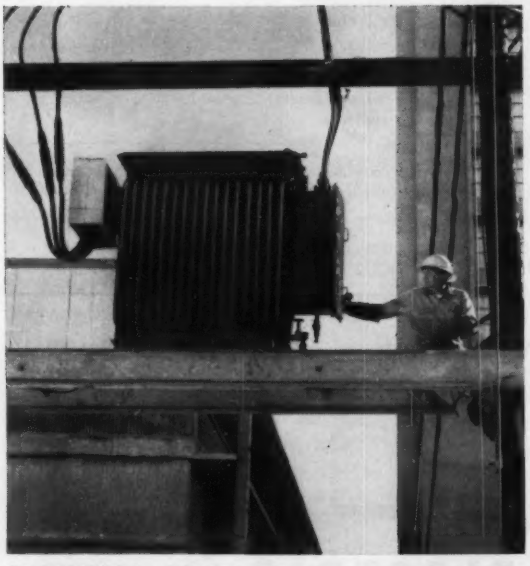
Single-phase Step Voltage REGULATOR FEATURE	G-E	A	B	C	MEANING OF FEATURE
Electrostatic Shielding	YES	NO	NO	NO	Helps prevent build-up of arc-causing carbon deposits at critical points.
Controlled Switch Speed	YES	NO	YES	YES	Gives longer contact life. Means less maintenance.
32 ⅛% Step Regulation	YES	YES	YES	NO	Provides closest voltage control. Less contact wear.
Locking Screws On All Control Knobs	YES	NO	NO	NO	Makes sure that settings stay set.
Panel-mounted Reverse-Reactance Switch	YES	YES	NO	YES	Simplifies parallel or delta-connected applications.
Plug Connections On All Major Control Components	YES	NO	NO	NO	Allows easier, quicker maintenance of control.
Complete Range of Ratings	YES	YES	NO	YES	Facilitates your system planning.
One-piece Cover Bands	YES	NO	NO	NO	Simplifies maintenance. Pleasing appearance.
Aluminum/Copper Terminals	YES	NO	NO	NO	Offers flexibility; either type of conductor can be connected.
Lightning Arrester For Control Circuit	YES	YES	YES	NO	Provides additional protection to vital regulator controls.
Internal Thyrite* By-Pass Resistor	YES	NO	NO	NO	Affords maximum protection with no chance of external damage.
Steel Control Panel	YES	NO	YES	NO	Provides rigidity. Panel will not warp or break.

FOR MORE INFORMATION on the benefits your system can get with General Electric feeder voltage regulators, contact your G-E Sales Representative or write Section 423-19, General Electric Co., Schenectady 5, N. Y.

*Registered Trademark of General Electric Company for Resistance Material.

Progress Is Our Most Important Product

GENERAL ELECTRIC



SPANNING ALLEY, this G-E platform-mounted network transformer is close to load, yet out of the way. When necessary, servicing the unit is quick and easy.

Network system

Texas Power & Light Company uses platform mounting for transformers to meet rapidly expanding loads

Rapidly expanding commercial loads will soon outgrow Texas Power and Light's radial system in downtown Tyler, Texas. The utility, therefore, is installing a number of General Electric network transformers on the present system to help carry the load. Quickly and easily serviced, the transformers and the platforms are installed convenient to the load—behind buildings, over alleys, in back yards.

LOW INSTALLATION COSTS result from mounting G-E network transformers on platforms. This unit serves high-density load in the downtown area of Tyler, Texas.

for tomorrow goes up in the air today

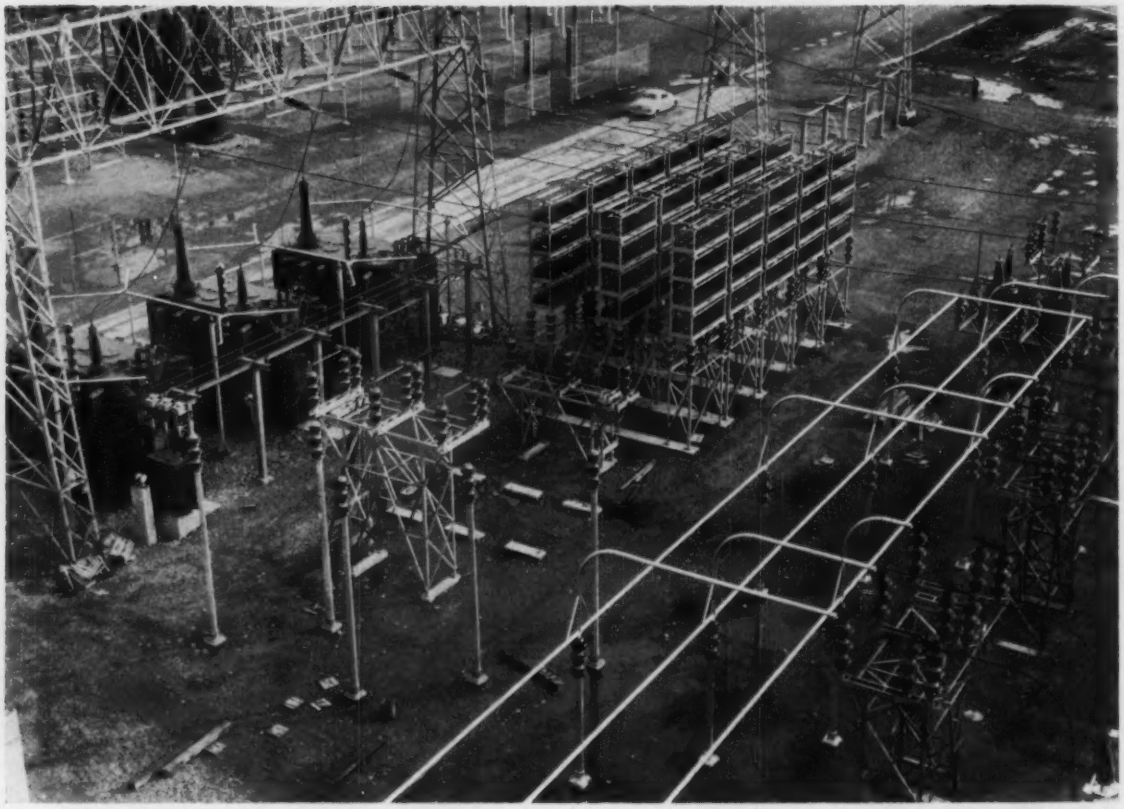
EASY TO CONVERT TO NETWORK SYSTEM. Texas Power and Light plans to convert its radial system eventually to an overhead secondary network system. Conversion cost will be low since the network transformers are already installed and cabling will be the same. Only network protectors must be added to the system, now protected by fused aerial cable.

HELP FOR YOU. Plan *now* to meet tomorrow's load growth problems. Remember, it costs less in the long run to increase capacity by changing to a network than by expanding a radial system—and the sooner you start, the less it will cost you. Your nearest G-E Apparatus Sales Office will be glad to help you draw up a future network system. Or write for Bulletin GEA-2432, General Electric Co. Section 431-61, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC



FIRST OF FOUR 39,000-kvar, 115-kv capacitor banks is installed at Bothell Substation. Two initial banks will supply reactive losses of transmission and subtransmission lines and transformers serving half of Seattle

SUBSTATIONS—Design

Capacitors on 115-Kv Bus Cost Less

R. L. SKONE, Supervising Senior Engineer, Department of Lighting, Seattle, Wash.

A. W. MOODY, District Manager, Application Engineering, General Electric Co, Seattle, Wash.

An investigation of the economics of location of reactive supply has prompted plans for the installation of four 39,000-kvar banks of switched capacitors on the 115-kv bus of Seattle City Light's Bothell substation.

These rack-type banks are believed to be the world's largest installation of switched capacitors. The first two banks, totaling 78,000 kvar, are planned to be on the line this year. A third and a fourth 39,000-kvar bank will be installed in the future, these two additional banks ultimately providing a total installed capacity of 156,000 kvar.

In determining the most economical location for capacitors, these conditions were considered. The northern half of City Light's system is supplied by four major 115-kv receiving substations. These are supplied from Bothell substation, a 230-115-kv bulk power and switching station about 20 miles north of the city. Reactive requirements of the system beyond the receiving substation 26-kv buses are met by 26 and 4-kv capacitors on the distribution system. Additional capacitors were needed to supply the reactive losses of the 115-26-kv transformers, the 115-kv lines, and the 230-115-kv transformers.

Voltage Change Not Excessive

To supply these losses economically, it was found that $0.75 per kvar more could be spent over and above the cost of 26-kv capacitors for 115-kv capacitors to be located at Bothell substation. In addition, the installed cost of switched capacitors at 115 kv is about $0.45 per kvar less than the cost at 26 kv. The saving in capacitor installation cost is realizable primarily because of the larger capacity which may be switched at 115-kv without excessive voltage change. Calculated voltage rise

(*Continued on page* 70)

electrical wonder rubber OFFERS TRIPLE VALUE

Performance! Versatility! Economy! In all three, Enjay Butyl is the world's outstanding rubber value. In a wide variety of applications, Enjay Butyl rubber stands *unmatched* in its ability to resist ozone and corona, impact and abrasion, moisture and weathering . . . properties that contribute to the *outstanding* performance of Butyl-made products.

Instrument transformers, underground service cables, high voltage industrial cables . . . in these, and many other electrical applications, Enjay Butyl out-performs and out-lasts *all other* types of rubber, synthetic *or* natural. *Low-in-cost* and *immediately available*, this truly wonder rubber may well be able to cut costs and improve performance in *your* products. For further information, and for expert technical assistance, contact the Enjay Company.

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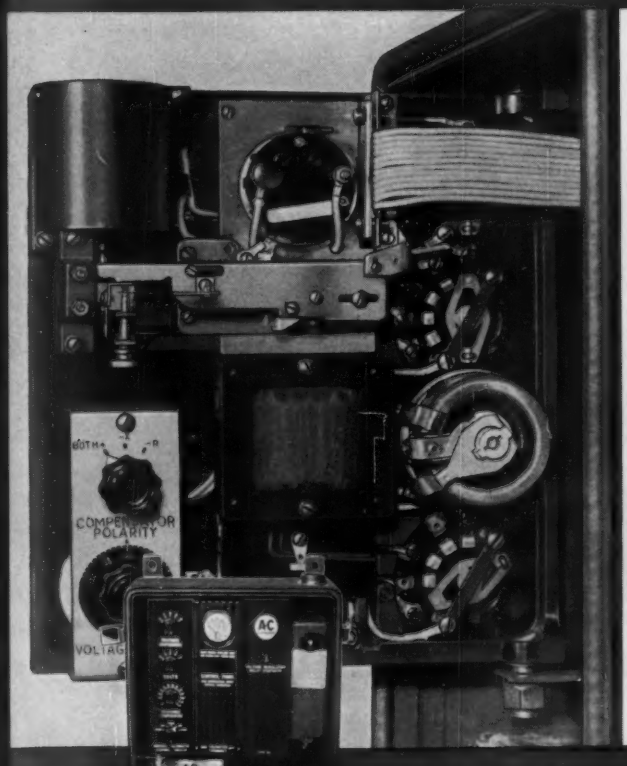
ENJAY BUTYL

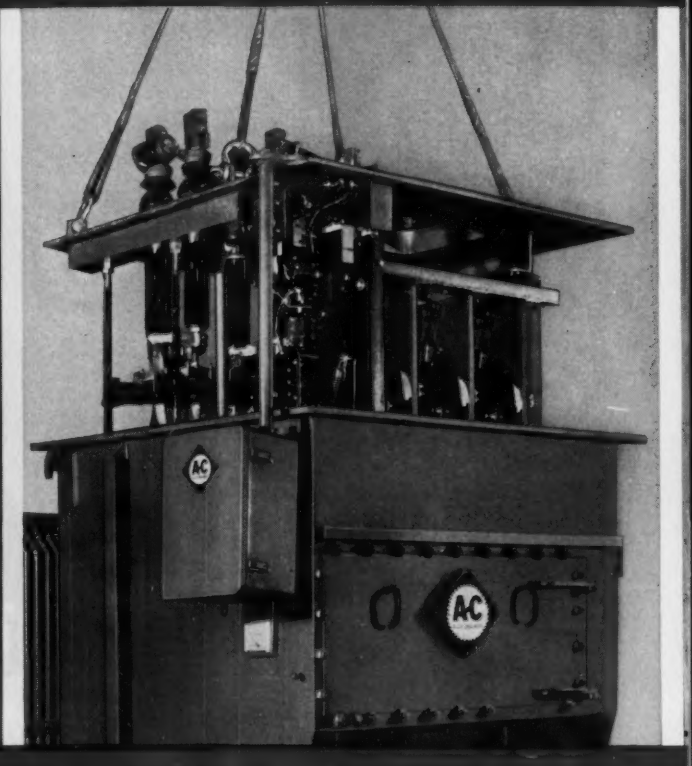
Enjay Butyl is the greatest rubber value in the world . . . the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

Allis-Chalmers three-phase

Always a step

Continual engineering development and laboratory testing produce constant regulator improvements.





New control panel

Handy control diagram on inside of panel cover . . . nickel-plated parts . . . stabilizing coil on solenoid of voltage-regulating relay . . . readily accessible contacts on voltage-regulating relay . . . rustproof plastic coating on open edges of control cabinet . . . and many other features.

New gear motor

Acceptance tests for gear motors include breakdown testing in hot transformer oil. Motors are driven against a mechanical stop and must survive at least 40,000 operations (equivalent to 5 million tap changes).

Vari-Amp is an Allis-Chalmers trademark.

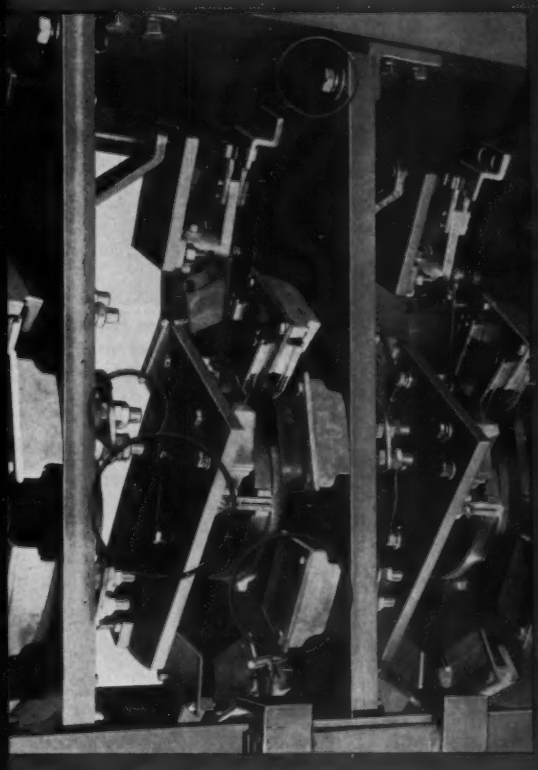
In addition to all these improvements, unit construction, *Vari-Amp* and all the other original features make this the leading regulator. For complete details, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

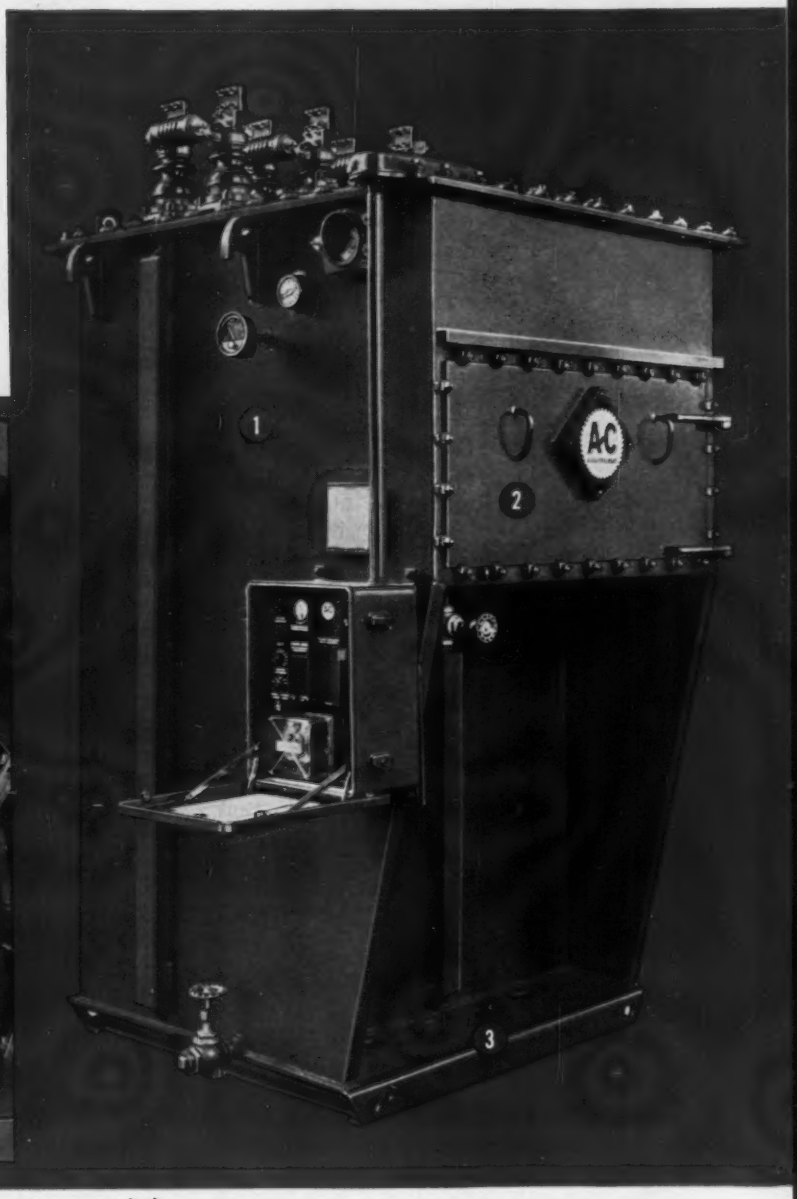
A-C ALLIS CHALMERS

A-5392

station step regulators

ahead





New reliability

Locking devices are engineered to meet requirements of long life. Shown are locking strips, double nuts, prick-punched lock nuts and lock washers, as well as wired bolt heads.

New painting techiques... hinged door...skid mounts

1. **Better finish** results from continuing study . . . adds service life under any atmospheric condition.
2. **Inspection door** has reusable synthetic gasketing that fits into a groove . . . permits tightening down metal-to-metal contact.
3. **Skid mounts** permit easier movement of regulator in either direction . . . add strength and rigidity.

ALLIS-CHALMERS

Capacitors Cost Less

(*Continued from page* 66)

caused by switching each 39,000-kvar bank onto the 115-kv bus at Bothell is about 1%. Because only about six such switching operations will be made per day, no trouble is expected from light flicker.

Each capacitor bank consists of 25-kvar units each rated 6,640 v. Single-bushing units were selected over 50-kvar units because banks of 25-kvar units were less expensive when bids were submitted. Each bank is wye connected with the neutral grounded. The grounded-wye connection was preferred over the double wye because twice as many units in one series group can fail without producing an overvoltage on the remaining units in that group.

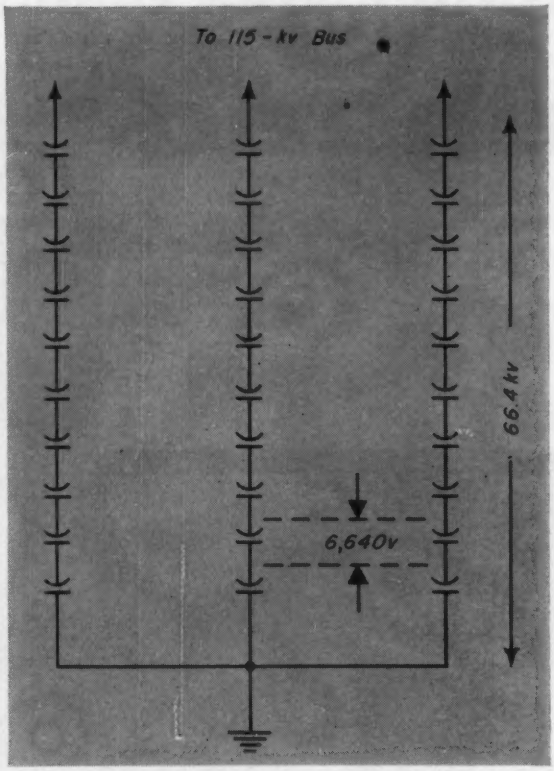
Harmonic Voltages Low

An investigation of harmonic voltages present on the 115-kv bus at Bothell showed them to be so low that excessive harmonic current would not flow with the neutral grounded. Because the substation is attended, it is not costly to provide daily inspection for blown capacitor fuses.

Grounding of the neutral results in these benefits: Operating duty on circuit breakers is reduced; the bank is essentially self-protecting against surges; use may be made of neutral current relaying for inexpensive and more reliable protection against major faults in the capacitor bank or structure.

Differential relay protection is provided for the 115-kv bus to which the capacitor banks are connected. Each capacitor breaker also is provided with time-overcurrent relays. Protection of the capacitor bank against failure of over 10% of individual capacitor units is obtained with sensitive neutral-overcurrent relays. These special relays were developed by City Light engineers.

Capacitors will be switched by manual control. It is expected that kvar flow through the 230-115-kv banks will be used to indicate the need for a switching operation.



GROUNDED-WYE CONNECTION was selected because twice as many units in one series group can fail without producing an overvoltage on the remaining units in that group

DISTRIBUTION—Maintenance

Coil Presses Designed to Speed Motor Repairs

J. N. McGINNIS, JR, Foreman, Armature Dept, General Repair Shop, Georgia Power Co, Atlanta, Ga.

Hot and cold coil presses developed by Georgia Power Co speed the repair of electric motors rated up to 4,200 hp.

Materials Used

The presses compact the coil sides better, permitting increases in insulation and consequently dielectric strength. The resulting coil is more solid, and the motor easier to wedge. There is less chance of failures caused by vibration.

The presses were designed for coils having sides ranging from 18 to 54 in. Material for the two presses included for 10-in. pneumatic cylinders and two of each of the following foot valves, speed regulators, pressure gauges, lubricators, and hollow V-block castings about 60-in. long. Some scrap steel shapes were also needed.

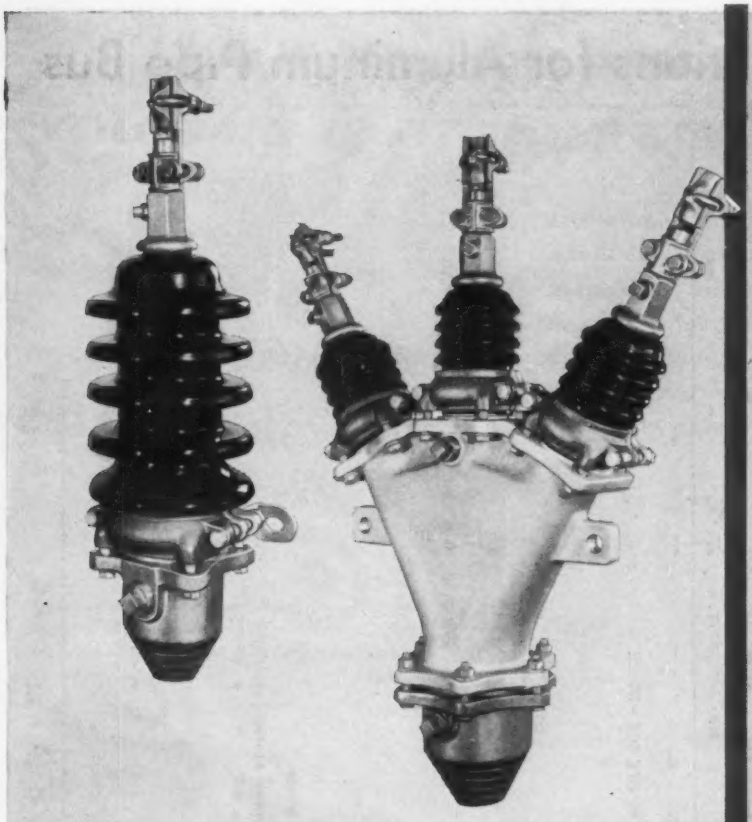
Operate on 80 to 125 Lb

Two pneumatic cylinders on each press exert uniform pressure for the full length of the coil side, and two cylinders, connected to male dies, permit pressing of two smaller coils simultaneously. Cylinders operate on 80 to 125-lb air pressure.

The hot press is heated to 120C by circulating live steam through the hollow V-block chamber. The cold press is cooled by circulating water through the chamber. In 3 to 4½ min a coil can be cooled for removal.

Gives Solid Coil

The presses are used for all form-wound coils of motors larger than 50 hp and having Class A or B insulation. After each coil is formed, it is heated in one press and cooled in the other. This treatment gives a solid coil.



NEW Delta-Star Seal-Kap Terminators are available in both multiple conductor and single conductor types, offered in a wide range of sizes and entrance fittings.

Cutaway of Seal-Kap Terminator conductor showing air-tight O-ring neoprene gasket at porcelain-to-metal joints.

Cutaway of Seal-Kap Terminator base showing pressure-tight seal at metal-to-metal joints.

NEW, advanced line of DELTA-STAR *Permanently-Sealed* Terminators

The big feature of this new line of Delta-Star Seal-Kap Terminators is the permanent-seal construction—using pressure-tight O-ring neoprene gaskets at all joints. The terminator is permanently air-tight and moisture proof, with a partial vacuum created inside it.

Insulating oil and compound inside Seal-Kap Terminators cannot escape even when heating causes expansion. Many sealing arrangements are used on terminators, but none is more effective than the new Seal-Kap method.

Among other Seal-Kap advantages are economy in original cost—and economy through ease of installation and maintenance.

A range of sizes is available to meet most terminator applications—in both multiple and single conductor types. Get complete information—just ask for the new Seal-Kap catalog.

For your best *new* buy in terminators, call on *Delta-Star Electric Division, H. K. Porter Company, Inc., Chicago 12, Illinois. District offices in principal cities.*

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc.: Connors Steel, Delta-Star Electric, H. K. Porter Company (Canada) Ltd., Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings.

Determine Deflections for Aluminum Pipe Bus

L. T. GUESS, Electrical Conductor Division, Aluminum Co of America, Pittsburgh, Pennsylvania

Deflection of aluminum pipe size conductors can be determined by the aid of the accompanying nomogram.

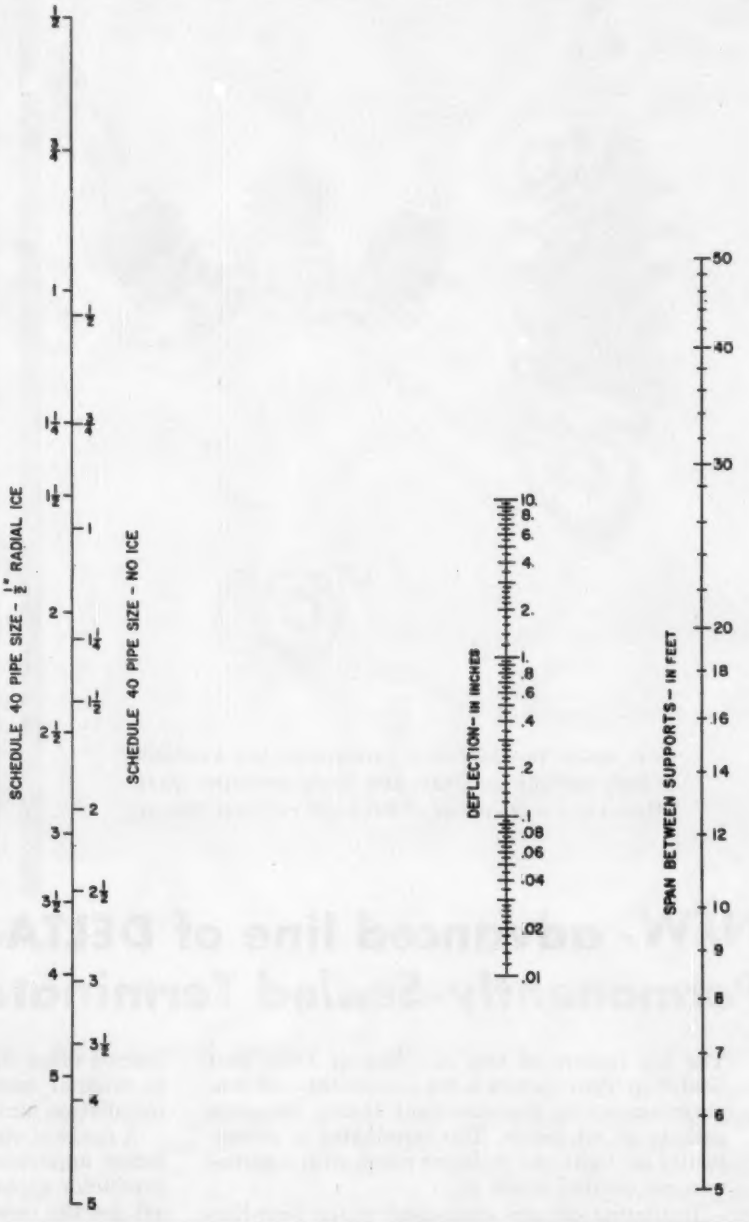
This nomograph is based on calculations for a single span simply supported at both ends. Length of span is usually determined by structural conditions. If the bus is fixed at both ends, 1/5 of the nomogram value should be used. If the bus is continuously supported in two equal spans but not fixed at each end, 2/5 of the value obtained should be used.

To use the chart, a straight edge is placed on the value for the pipe size (left scale) and on the value for the span (right scale); then the pipe deflection is read on the center scale.

Selection of pipe size is then decided if it does not exceed permissible deflection limits. (Current carrying capacity and short circuit conditions are also checked.)

Mechanical considerations, rather than electrical requirements, usually govern the selection of buses for substations associated with transmission and distribution systems. For medium voltage substations, the size of bus may be dictated by stresses caused by short circuits. For high-voltage buses, where the current is relatively low and phase spacing large, the deflection of the conductor usually determines the size. Some engineers limit the permissible deflection of unloaded conductors to 1/150th of the span where two supports are used, and to 1/200th of the span where three or more supports are used. Others determine the size of conductor on the basis of a maximum deflection equal to the diameter of the tube (or the height of section) for National Electric Safety Code heavy loading assumption.

Accompanying table lists aluminum alloys normally used for bus conductors in outdoor substations:



Properties of Alloys Used for Tubular Bus Conductors

Aluminum Alloy No.	Strength, psi				Electrical Conductivity, % IACS @ 20 C Typical	Modulus of Elasticity, psi
	Minimum		Typical			
	Tensile	Yield	Tensile	Yield		
6063-T6	30,000	25,000	35,000	31,000	53	10×10^6
6061-T6	38,000	35,000	45,000	40,000	40	10×10^6
1100-H18	22,000	.....	24,000	22,000	57	10×10^6

These data are adapted from "Alcoa Bus Conductor Handbook". Copy of the book may be obtained by writing Aluminum Co of America, 792 Alcoa Building, Pittsburgh 19, Pennsylvania

Your Westinghouse representative can prove...

YOU GAIN 12"-17" HOT LINE CLEARANCE

and eliminate pinched fingers with new, exclusive Westinghouse eyebolt, I-beam mounting (3-50 kva). Forged steel eyebolt seated in forged steel I-beam. Tensile strength is independent of cover. Every transformer is production-line pull-tested for 200% safety factor.

YOU CAN BE SURE...IF IT'S

Westinghouse

Jack McQuillan, Director of General Services, West Penn Power, and Don Burns, Westinghouse representative. "The eyebolt construction is a major safety improvement in pole-type distribution transformers" ... Mr. McQuillan. J-70792

NEW HIGH-LEVEL STREET LIGHTS in Great Falls, Mont., are the result of that city's 'improvement districts' street lighting plan. More than 5,000 lights have gone in so far, with upwards of 1,000 slated for installation during this year

Boost Lighting in 160 Montana Towns

Most of the towns on Montana Power Co's lines have better street lighting as a result of a unique "improvement districts" plan.

Biggest success story belongs to Great Falls, a town with a 60,000 population. Under its improvement districts plan, more than 5,000 new lights have gone into the business and residential areas, with upwards of a 1,000 more slated for installation this year. By the end of the year, almost 80% of the city will have high-level lighting.

Trial Gave Birth to Plan

The first district was formed as a result of a successful experiment in which Montana Power installed a five-block strip of high-level lights in Great Falls. The lights were given a 90-day trial; the residents liked them, and an "improvement district" was formed to pay for them.

Details: Residents form an improvement district, subject to City Council approval. The district and Montana Power then draw up a 3-yr contract under which the utility owns the fixtures, and the district and city split the monthly charge. The power company's bill is made up of an energy charge, which depends on the type of lamp installed, plus a maintenance charge.

The lighting has been going into many areas undergoing general street improvements, such as paving and sewer work. Montana Power Co provides temporary lighting to these areas during construction period.

The utility encourages formation of improvement districts by providing advice and help to residents. Results have been excellent: Of the 181 communities served by the utility, 160 have improved lighting systems.

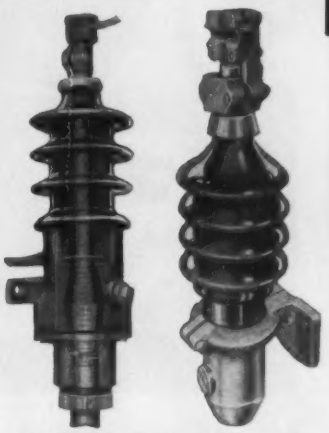
(*More Selling on page* 76)

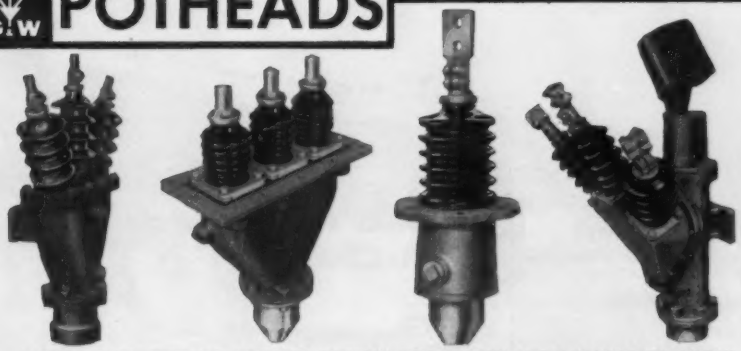
DP&L Keeps to 'The Middle of the Road'

Dayton Power & Light Co has come up with this experimental street lighting system which uses a continuous strand of fluorescent down the middle of the street. The 200-ft installation, said to be the first of its kind in the country, provides good, uniform diffusion of light.

Devised by D. S. Nonneman, head of DP&L's municipal affairs department, the new system solves the age-old street lighting problem of where and how far apart to locate standards. Nonneman says he got the idea from interior lighting systems, many of which use continuous lines of fluorescent tubes.

G&W POTHEADS



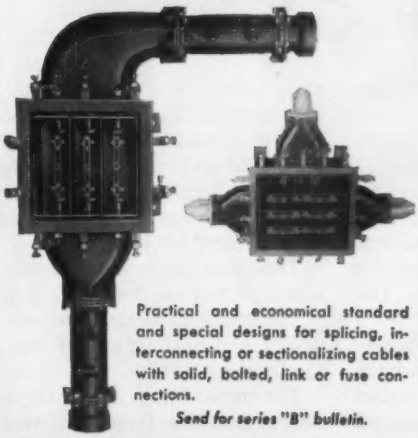


A TYPE AND SIZE OF PROVED DESIGN FOR EVERY HIGH VOLTAGE CABLE.

Sodertite, Capnut, Disconnecting—Solder, Clamp or Press style connectors for copper conductors, Press style for ALUMINUM conductors—Wiping sleeve or stuffing box cable entrance seals—Conduit and armor fittings—The G&W line of potheads is complete.

Send for series "A" bulletins.

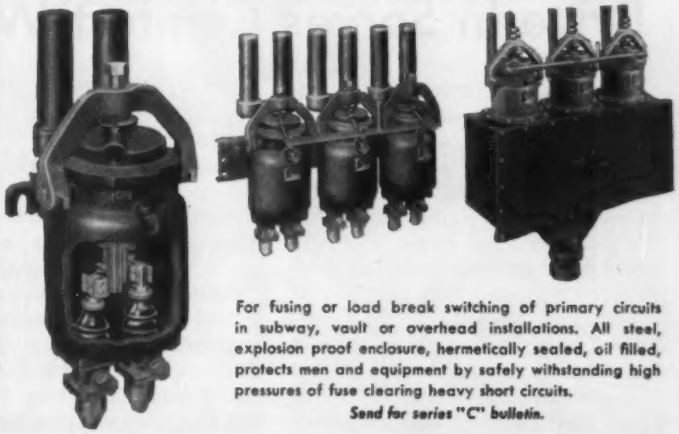
G&W BOXES



Practical and economical standard and special designs for splicing, interconnecting or sectionalizing cables with solid, bolted, link or fuse connections.

Send for series "B" bulletin.

G&W OIL FUSE CUTOUTS



For fusing or load break switching of primary circuits in subway, vault or overhead installations. All steel, explosion proof enclosure, hermetically sealed, oil filled, protects men and equipment by safely withstanding high pressures of fuse clearing heavy short circuits.

Send for series "C" bulletin.

G&W LOAD BREAK OIL SWITCHES

PROVIDE CABLE SYSTEM FLEXIBILITY

Reduce overtime work on system maintenance. Sectionalize your distribution system with Type "RA" load break oil switches. Isolate cable faults and restore service by switching loop or duplicate feeders—manually or automatically.

Send for series "D" bulletins.

G&W SPLICING KITS

SAVE TIME AND MONEY

- Each item supplied in the correct quantity for a properly designed joint.
- Time and expense of securing various items from different sources are saved.
- Accumulation of dead stock is avoided. No waste.
- All materials are kept clean and ready for use.
- Each Splicing Kit is labeled for easy identification.
- Cable splicing costs can be determined accurately.

Send for series "J" bulletins.

Complete catalog including separate bulletins on various cable devices will be sent on request

G&W ELECTRIC SPECIALTY CO.

3500 W. 127th Street, BLUE ISLAND, ILL. G571

Representatives in many cities of N. and S. America Canadian Mfr. Powerlite Devices, Ltd., Toronto, Montreal and Vancouver

Quality cable devices since 1905

Clean, cool air overhead is . . .

Carrier Corp photos

pumped into cars as . . .

Drive-In Serves Comfort With Calories

The road to universal air conditioning now passes *through* the drive-in restaurant, not *by* it! That's the story in Nevada, anyway.

Drivers who pull into the Blue Onion Drive-In Restaurant in Las Vegas, Nev., get clean, cool, dehumidified air even before they are handed a menu. And they love it! "Car-hops" hook on an air conditioning outlet or "boot" at the end of a flexible conduit through the car window and up against its ceiling (see illustrations). Driver controls the air flow to suit himself. The system provides both cool air in summer and warm air in winter.

It can handle up to 30 cars along the 250-ft air conditioned "Weatherwalk." The outlet had to be engineered to (1) fit all makes and models of cars and trucks; and (2) not be damaged if the driver neglected to disconnect it before driving away. Reportedly, no vehicle has stopped at the Blue Onion that one could not "take" the boot. The second feature was provided by a dual-spring arrangement and breakaway clip. If the driver does back out without unhooking the outlet and duct, they will drop undamaged alongside the car. They then can easily be re-inserted.

The restaurant is no slacker as a load builder. The automobile air conditioning system, plus one for the interior of the building and some electric commercial cooking equipment, add up to a connected load of 422 kw. Total consumption during May, 1957, was 74,024 kw, while peak demand hit 172 kw.

The Blue Onion is connected to Southern Nevada Power Co's lines.

The utility cooperated in both the design and installation of the air conditioning systems.

The public has gone for the auto air conditioning feature in such a big way that the restaurant's manager predicts within five years every other drive-in in the area will have a similar system.

COMPETITOR'S CORNER

Gas A.C.—Sooner Than You Think?

Electric utilities may have to grapple with the problem of low-cost gas-fueled air conditioning sooner than they think. Big reason: The gas industry is renewing its efforts to research and develop commercially practical units.

In a recent editorial Gas Age reported the announcement of American Gas Association that its PAR (Promotion, Advertising & Research) Committee reviewed the research and development of gas air conditioning, and decided to *double* its funds for the purpose. This means an additional $375,000. Commenting on the revised program for gas A.C., Leon Ourusoff, chairman of AGA's Task Force for Air Conditioning, said, "Until now, A.G.A. has concentrated its efforts in the gas air conditioning field on what might be termed fundamental projects and processes in the knowledge that manufacturers in the industry were at work on systems which might result in more immediately marketable services. The anxiety of our industry to have more air conditioning equipment available for the market, however, has led to a change in philosophy. It is now our plan to place more emphasis on systems for gas air conditioning which could be brought to market at the earliest possible moment."

The way it looks now, most of the equipment now under development will be ready for testing by the end of 1957.

(*More Selling on page* 80)

New "25" is lighter and smaller

General Electric's new 25-kvar capacitor is 22% lighter and 30% smaller than the former design. On pole-tops, where most 25s are now used, this means a weight reduction of about 16 pounds per capacitor, or nearly 200 pounds for a 300-kvar equipment.

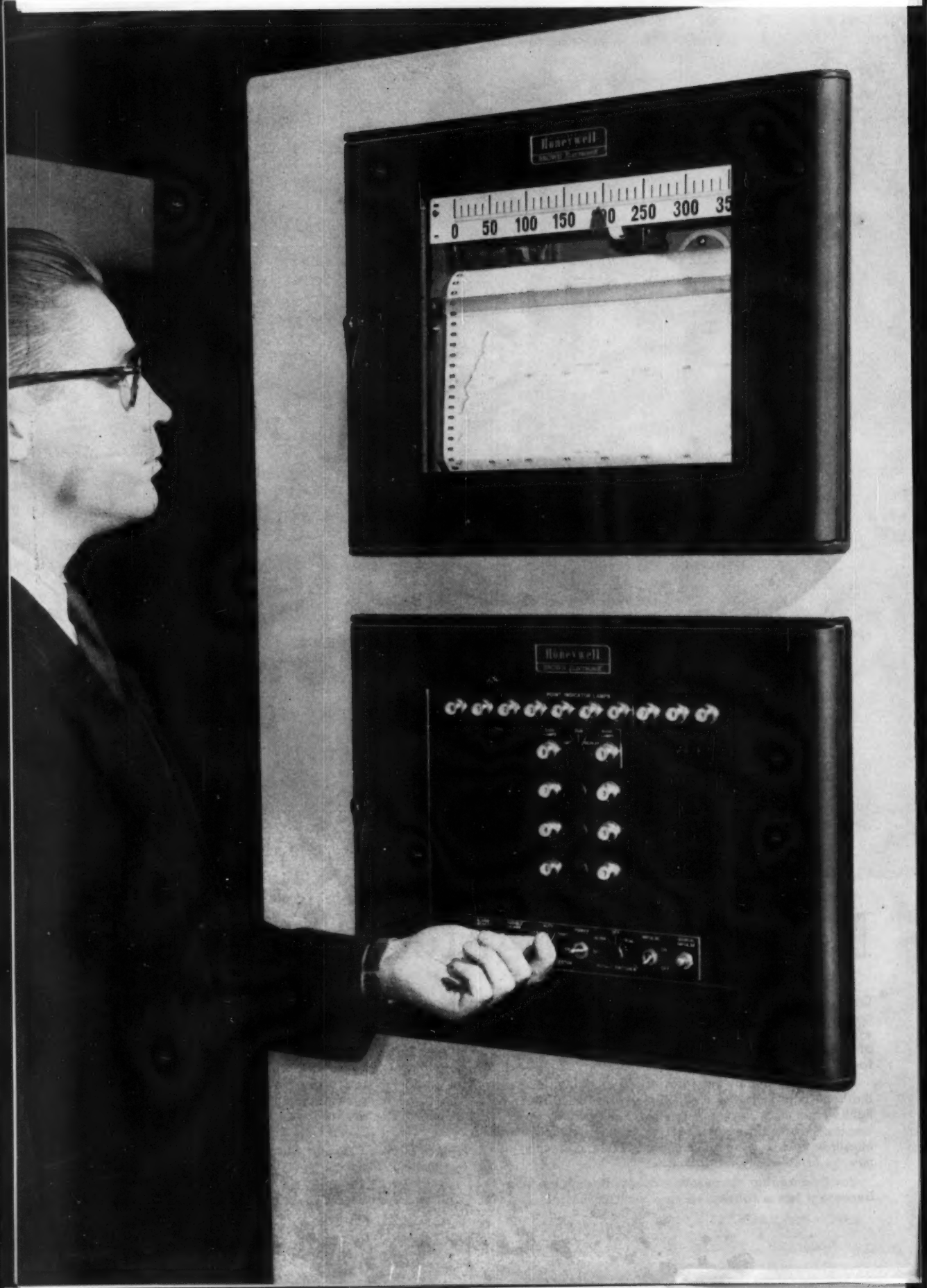
Yet, neither quality nor life have been sacrificed. All that's missing from the new capacitor is bulk. The new light-weight units, made possible by G.E.'s exclusive extra-low-loss kraft paper, are easier to handle, hoist, and install. In fact, a General Electric 25-kvar capacitor can now be lifted easily by one man.

You'll notice that the new unit looks different, too. That's because it has a fabricated case with all the features of the larger 50-kvar capacitor, including new corrosion-resistant case material. The new 25 meets all NEMA standards and in most cases is fully interchangeable with old-style 25-kvar capacitors—for large rack and housed equipments, simple adapters are furnished on request.

That's the basic story. Your G-E Apparatus Sales Engineer will be pleased to supply the details. Or write to General Electric, Section 445-8, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC


Honeywell
0 50 100 150 250 300
Honeywell

Automatically monitor all low and high temperatures

with the *ElectroniK* scanning system

Save the cost of using individual instruments to monitor plant temperatures. Use this efficient, highly flexible *ElectroniK* system for continuous, automatic scanning. With this one unit you can monitor hundreds of temperature points—record temperatures in boiler tubes, drums and feed pumps . . . fan, turbine and generator bearings . . . transformers . . . hydrogen cooling systems.

Important operating advantages of the *ElectroniK* scanning system include:

Flexible operation of printing system—

- temperature recorded only when set point is exceeded
- continuous recording
- no recording but continuous scanning
- only manually selected points recorded and/or scanned

High scanning rate—3 seconds per point

Independent set point—provided for each bank of nine points

Indicator lamps—identify point of measurement

Synchronism between scanning and printing—if lost during manual manipulations, synchronism is automatically restored

Scanning is uninterrupted—by printing or alarm functions

Sensing elements—low cost thermocouples used

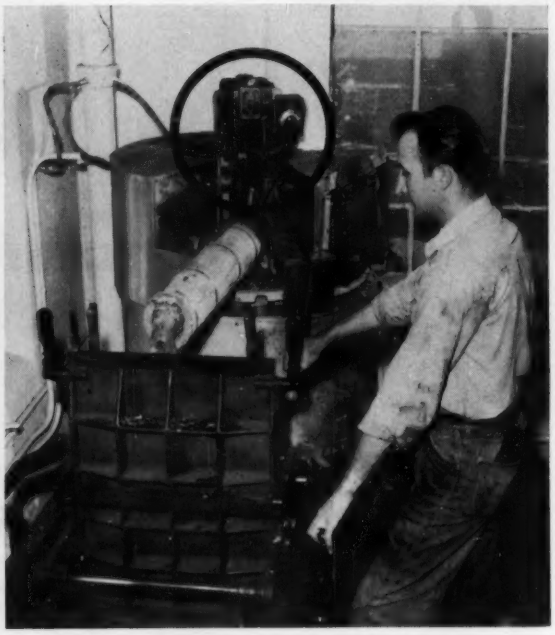
For complete details, call your nearby Honeywell field engineer. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

H HONEYWELL *First in Controls*

Electrified metal melting pots . . .



. . . thermostatically controlled . . .

Boost Casting Quality, Raise Pot Capacity

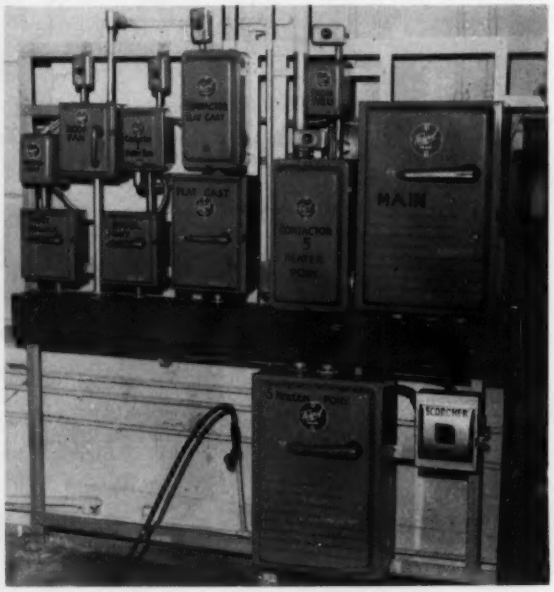
CLYDE JONES, Industrial Power Engineer, West Penn Power Co, Washington, Pa.

Uniform quality castings of typesetting and printing plate metal are only one of the benefits of a switch to electric heat at the Observer Publishing Co, Washington, Pa. According to executive vice-president and general manager James Lyon, the change has eliminated a burdensome heat problem and increased the capacity of the larger melting pot by 40%. The even heat and accurate temperature control eliminate guess work and reduce the amount of dross. In a comfortable shop employees do more productive work.

The newspaper electrified the two pots in its stereo room last year. The larger machine, used to cast metal pigs for the typesetting machines and the semi-circular printing plates, is now heated by six 5-kw standard immersion units. The small re-melting pot has two 3-kw heaters. On both pots, thermostats control the heat and maintain the required 600 F temperature to within four or five degrees.

Removal of the burners from the large pot increased its capacity by two tons. Substitution of electric heat also eliminated a heat problem in the stereo room. During the first summer of electric operation, the room temperature averaged 10 F coolor than during the last summer of fuel-fired operation. Heat now goes into the metal instead of the room. And the roaring noise of the burning fuel is gone, too, leaving the room quiet.

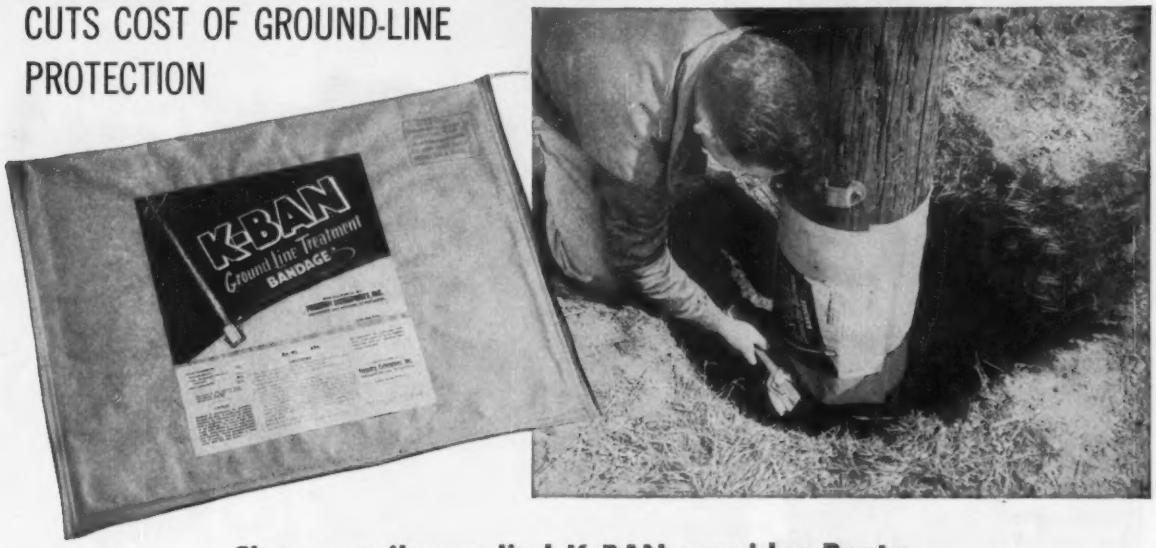
Nerve center of the electrified metal melting operation is a modern, compact switching and contactor installation, grouping all the controls for the equipment in one location. The electrified pots are automatically controlled so that they will not operate when the presses are running, making for a more economical operation.



Compact nerve center includes switches and controls for all pot heaters. Each control is clearly marked

NEW K-BAN PENTA POLE BANDAGE

CUTS COST OF GROUND-LINE PROTECTION



Clean, easily applied K-BAN provides Penta protection . . . always ready for quick application wherever needed

TEAR-STRIP adds to K-BAN convenience. Bandages are available in sizes to fit all poles.

OPENED BANDAGE is wrapped around pole and stapled in place, top edge 2" above ground line.

COMPLETED TREATMENT looks like this. Shovel, wire brush and stapler are only tools needed.

New K-BAN is a pole-saving ground-line bandage designed for easy, fast, clean application. It is completely sealed, ready for instant use.

Inside the tough plastic-coated kraft paper backing is POL-NU, a grease-type protective compound containing 10% PENTAchlorophenol. Water soluble, highly toxic sodium fluoride is also incorporated in K-BAN as an added feature. When wrapped around the pole at the ground-line, K-BAN provides a reservoir of preservatives which work into the wood to prevent decay and termite attack in this vulnerable area.

K-BAN bandages are low in cost and far more economical to use than conventional methods of ground-line preservative treatment. They give many years of extra pole life, cutting maintenance and replacement costs. Send coupon below for price list and additional information.

PROTECT OLD POLES, CHANGE-OUTS AND DAMAGED POLES WITH K-BAN

Make K-BAN Bandages standard equipment with all line crews

K-BAN—Trademark of Forestry Enterprises, Inc., St. Paul, Minn. Patents pending.
POL-NU—Registered trademark of Chapman Chemical Company, Memphis, Tenn.

CHAPMAN®

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Leading manufacturer of wood preservatives
Memphis 1, Tenn.
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Mail for K-BAN prices and data

Chapman Chemical Company
P. O. Box 138, Memphis 1, Tenn.

Please send prices and additional information on K-BAN to:

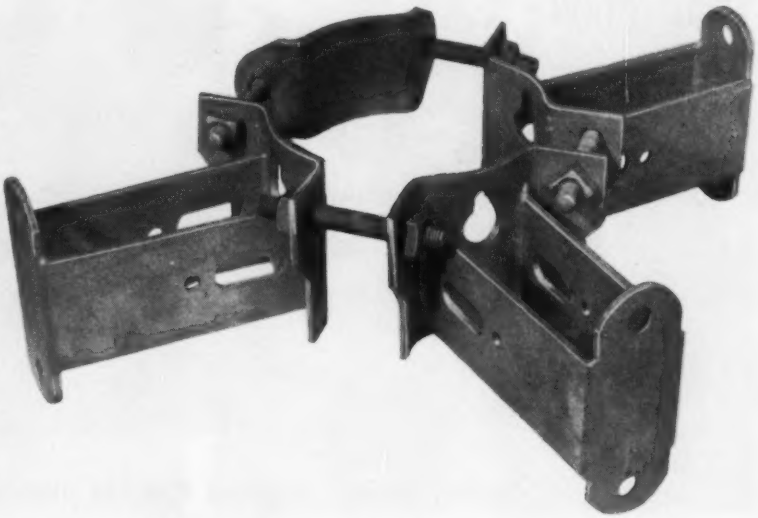
Name_____

Address_____

_____

NEW EQUIPMENT

Transformer Pole Bracket . . .



provides more climbing space and clearance between transformers. Extended model (shown) puts face of transformer lug nine in. from pole, is particularly useful for higher voltage transformers with sidewall primary bushings. Combination of extended units on sides, standard unit in center improves pole loading.

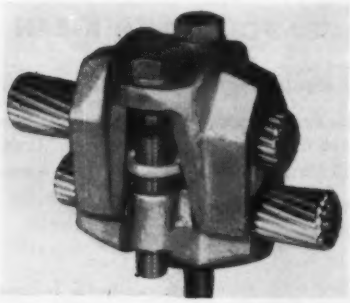
Tests show liberal safety margin for all distribution transformers equipped with lugs in single band installation of up to three 25-kva units with vertical adapter plates; two band installations of up to three 100-kva transformers without plates; or three 167-kva units with horizontal plates.

Universal Pole Bracket Corp, Box 8454, Houston 4, Texas

Class H Insulation . . .

for continuous operation at 200C in transformer windings, slot insulation, phase insulation, and coil windings is a flexible laminate of fiber glass and asbestos bonded with silicone adhesive. Named Arvey-H, its average overall dielectric strength is 1884 v, increased to 2265 v by 96-hr cure at 200C. Breaking load is 50 lb per in. width.

Arvey Corp, 300 Communipaw Ave, Jersey City 4, N. J.



Two-bolt Clamp . . .

with increased contact surface has better conductivity and less cold flow. Wrap-around finger on spacer encloses any conductor in the fitting's range. Pure aluminum spacer is specially treated to prevent oxide formation and assure low resistance path from run to tap. Top and bottom members are high strength aluminum alloy.

Clamp is one-piece fitting with staked long bolt and retainer ring on short bolt. Seven sizes fit conductors from No. 3 (No. 6 tap) to 1,000 Mcm. Fitting may be used either for aluminum-to-aluminum connections or, with copper on top, for aluminum-to-copper connections.

Penn-Union Electric Corp, Erie, Pa.

Silicone Rubber . . .

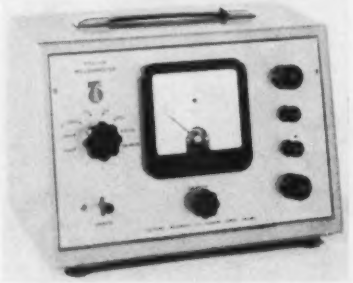
wire insulation for motor and apparatus leads stands long service at 150C, can be used for some applications at 200C, and will take intermittent temperatures up to 250C. Known as SE-975, the compound has low water absorption rate. After one-hr cure at 300 F, properties include: tensile strength, 1,150 psi; elongation, 425%; tear strength, 125 lb per in.

General Electric Co, Waterford, N. Y.

Meter Socket Clincher . . .

mounts meters on both square and round sockets in improved model. Device simplifies socket meter installation, securing meter quickly and firmly by snapping a locking device in place. Pounding and danger of breaking glass cover are eliminated.

F. D. Kees Mfg Co, Beatrice, Neb.

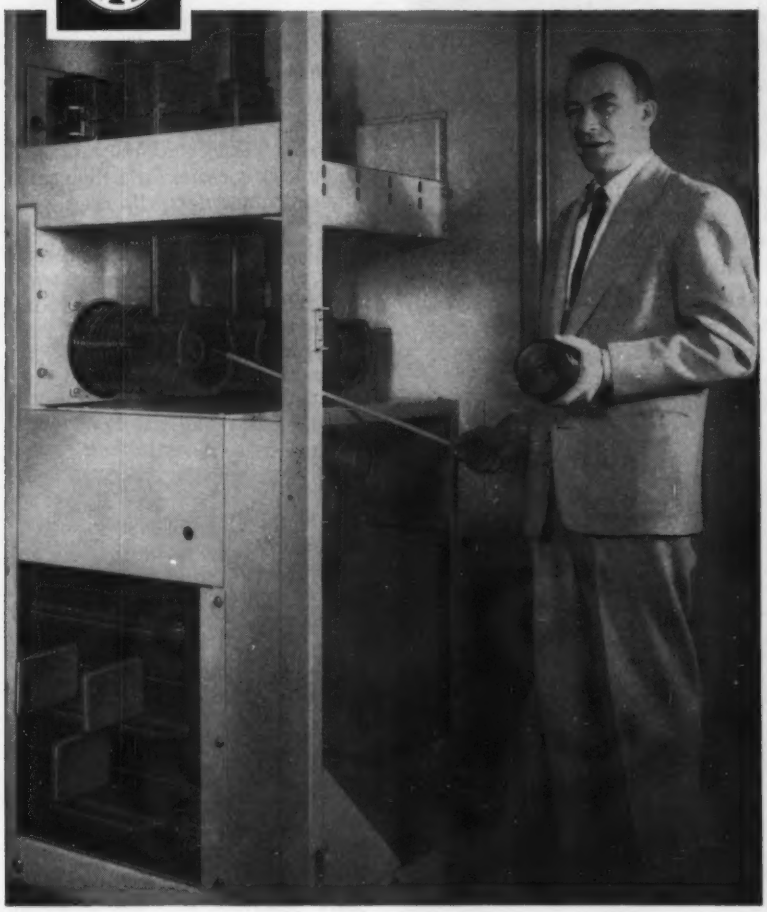


Portable Ohmmeter . . .

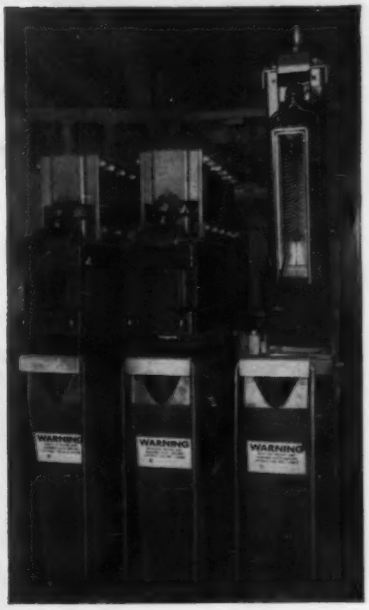
covers range of 20 micro-ohms to 1,200 ohms in seven decades. Designated as the Model 47A milliohmmeter, it uses a-c test currents at line voltage frequency and requires no batteries. Power dissi-

(*Continued on page* 84)

METAL-CLAD SWITCHGEAR



PURIFIED PORCELAIN in horizontal and vertical bus supports, primary disconnect bushings and caps and epoxy in bus joint covers provide excellent insulation, prevent fires in 15 kv I-T-E metal-clad switchgear. ◀



▲

EPOXY AND SPECIAL CERAMICS protect personnel and equipment by preventing fires in the circuit breaker section. Arc chute rear supports and blowout coils are epoxy. Jump gap cooling plates, arc chute liner plates, arc plates and spacers are special ceramics.

Only the finest fire-protective insulating materials

Nonflammable porcelain and ceramics, flame-resistant epoxy, and other flame-retardant insulating materials throughout, are among the extra values you find in I-T-E Metal-Clad Switchgear. Purified porcelain, of which the primary disconnect bushings and caps are made, also supports both vertical and horizontal bus. It is nonflammable, has high dielectric strength, won't track or deteriorate, is inherently contamination free.

Epoxy, which can be molded into complicated shapes, forms arc chute rear supports, blowout coils, bus joint covers, potential and current transformers. It has high mechanical and dielectric strength, is nontracking and extremely flame resistant.

Special ceramics, highly resistant to direct arc exposure, are used in jump gap cooling plates, arc chute liner plates, arc plates and spacers. These have high dielectric strength, low moisture absorption, won't track, are excellent interrupting materials. They do not deteriorate when subjected to direct arc exposure. They absorb thermal shock and deionize gases without excessive heating.

Phenolic and polyester insulating sheets and moldings, specially treated to provide the highest possible degree of flame-retardant characteristics, are also used.

If you are planning new construction or modernization requiring electric power, consider the advantages of I-T-E equipment. Consult your local I-T-E sales office or write I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES, LTD.

What Makes RT&E Transformers Better?

OUTSTANDING BASIC DESIGN

Easy to Install . . . Operate . . . Maintain . . .

Every RT&E Transformer combines the result of years of industry progress with the experience and creative thinking of RT&E Engineers.

The result is a transformer that is low on losses, regulation and weight — high in impulse strength and overload capacity. A transformer thoroughly tested for top performance.

RT&E Transformers are designed and built to the highest standards. A dependable product, produced by a dependable company and backed by a full five year guarantee!

RT&E CORPORATION
WAUKESHA, WISCONSIN

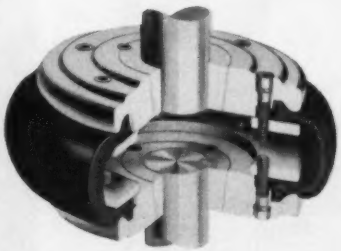
OUTSTANDING BASIC DESIGN — *Another reason why* **RT&E** *is better!*

Portable Ohmmeter

(*Continued from page* 82)

pated in the instrument does not exceed 0.125 w.

The direct reading instrument uses the four terminal principle. A built-in self-calibration circuit permits user to check accuracy quickly. Ohmmeter is useful for testing cable joints, commutators, slip rings, generator and motor armatures, cable sheaths and armor, grounding systems, lighting protection systems, and welding and furnace electrodes. **Herman H. Sticht Co, Inc, 27 Park Pl, New York 7, N. Y.**



Flexible Coupling . . .

handles end float and angular or parallel misalignment in any combination, to cushion shock loads and reduce vibration. Heart of the unit is a tire, clamped between two hubs, with synthetic tension members bonded together in the rubber. Mounted on the shafts of the driver and driven machine, the two hubs have flanges and clamps to hold the tire in place.

Clamps take angular misalignment up to four degrees, parallel misalignments to 0.125 in., or end float as large as 0.313 in. It needs no lubrication, is replaced by loosening a few cap screws.
Dodge Mfg Co, Mishawaka, Ind.

Variable Transformer . . .

with no electrical linkage between windings is useful as adjustable low voltage output source, limited range line corrector, or limited range "buck-boost" variable transformer. Identified as the Powerstat type LW136, it is a double wound assembly with an isolated secondary on a ingle core. Two primary windings

are arranged for either series or parallel connection.

Single phase, 120- or 240-v units have a 30-v range and maximum rating of 25 or 35 amp, according to application. Three phase units for 120-, 240-, or 480-v operation can be connected either delta or wye.

Superior Electric Co, Bristol, Conn.

One-hp Air Conditioner . . .

that draws only 7.5 amp at 115 v is rated 9,000 BTU. Known as the Model 712S, its power factor is 99.3%. Two-cylinder hermetic compressor with larger displacement permits high pumping rate with low current motor. Unit has big evaporator and heavy duty, three-row condenser.

Fedders-Quigan Corp, 58-01 Grand Ave, Maspeth, N. Y.

Voltage Regulator . . .

with no moving parts maintains constant voltage output from 208-v to 240-v/60-cps alternators. It works directly into a 20 to 100-ohm exciter field without adjustment and supplies exciter field current within a range of 0.15 to 1.35 amp. Single-stage magnetic amplifier uses selenium rectifiers, connects directly to alternator without need of a potential transformer. Used with a 500-va potential transformer, it operates with alternators of any voltage.

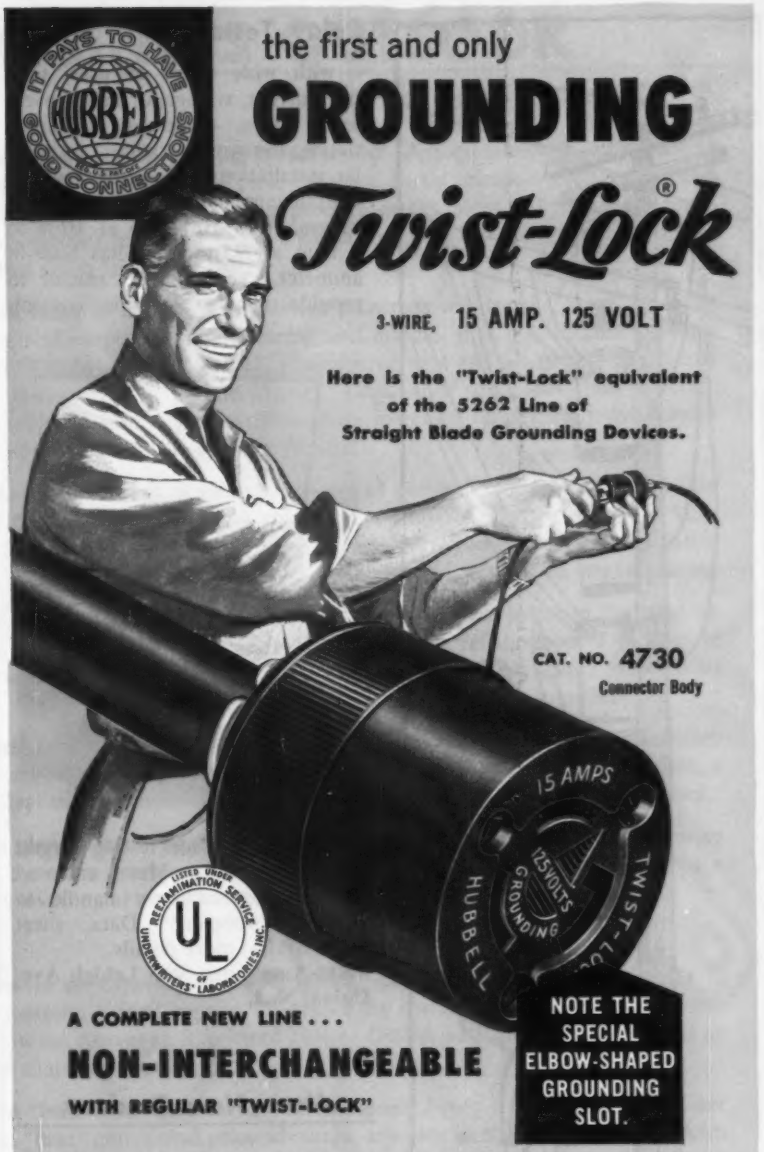
Vickers Electric Div, Vickers Inc, 1815 Locust St, St Louis 3, Mo

Wagon Drill . . .

with 10-ft feed travel for 8-ft steel changes is known as the DR-126-A. Improvement permits longer drilling time between changes. Equipment can be used for drilling and blasting trenches for electrical installation. High torque air motor may be throttled for infinite number of feed pressures.

Schramm Inc, 900 E. Virginia Ave, West Chester, Pa.

(*More News Equipment on page* 86)



These new 4700 Series Grounded "Twist-Lock" units are polarized to prevent interchange with regular 125-volt "Twist-Lock" devices. An elbow-shaped grounding slot prevents insertion of regular "Twist-Lock" caps, accepting 4700 Series caps only. With 4700 Series "Twist-Lock" units there is absolutely no danger of plugging into a 3-phase circuit by accident.

Write today, for complete information.

HARVEY HUBBELL, INC.

HIGHEST QUALITY
WIRING DEVICES • MACHINE SCREWS

DEPT. D BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

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Dallas 7, Texas
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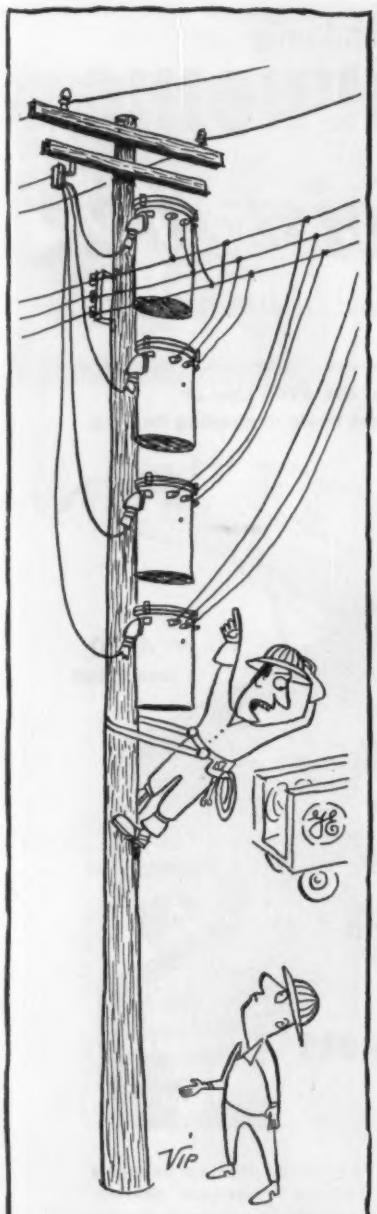


"They've finally decided that letting G.E. uprate one is a better idea!"

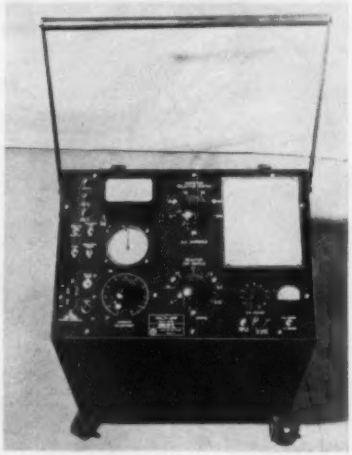
Need distribution transformers uprated fast? Call a General Electric Apparatus Service Shop. The shop can uprate your old transformers in both kva and voltage for about two-thirds the cost of new transformers . . . can also convert to self-protected type. And you get new transformer warranties. Call your G-E Apparatus Service Shop or Sales Office. 431-58

Progress Is Our Most Important Product

GENERAL ELECTRIC

Relay Tester . . .

with wide range of uses, tests overcurrent, voltage, or motor overload relays; complete switchgear timing; throwover schemes; or similar installations in industrial plants. Output current is adjustable in six ranges, from 100 amp at 10 v to 2 amp at 500v. Unit has built-in ammeter, cycle counter, reactor to provide sine wave, vernier control,



and d-c supply for testing targets and seal-in units. Metal enclosed unit has perambulator handle to facilitate wheeling. Data sheet 1010/SP has more details.
Multi-Amp Corp, 465 Lehigh Ave, Union, N. J.

More New Products

Federal Pacific Electric Co, 50 Paris St, Newark, N. J., offers molded case, two-pole **circuit breakers** in 70 and 100-amp ratings for use with Stab-lock panels.

Lockrey Co, Southampton, N. Y., has available Steelpatch **bonding material,** a alloy of micronized steel and epoxy resin for fastening conduit or piping to concrete without special tools or drilling.

Belltron Mfg Co, 242 Hoover Ave, Bloomfield, N. J., has available an Auto-Flash straddle **signal unit** which can be placed over temporary conductors as a warning for pedestrians. A 2.75-in. light is visible up to 400 ft in the dark.

INDIANA STEEL & WIRE CO. MUNCIE, IND. Crapo Galvanizing

Signs along the lines of *Crapo* GALVANIZED STEEL STRAND PERFORMANCE

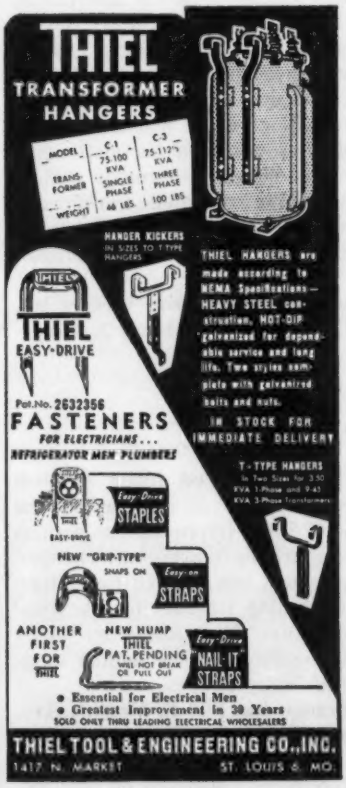
For dependable performance . . . insist upon *Crapo* Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes *Crapo* Steel Strand first choice for guys, messenger and overhead ground wire.

The famous *Crapo* galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.

- Low maintenance cost
- Laboratory tested and controlled quality
- Meets highest quality standards
- A size and grade for all practical needs
- Contact your *Crapo* Jobber Today!

INDIANA
STEEL & WIRE CO., INC.
Muncie, Indiana

THIEL
TRANSFORMER HANGERS



ELECTRICAL BUSINESS OUTLOOK

Electrical World
JULY 1, 1957

How fast is the economy growing in real terms? A good question and a sobering one. Many dollar records set these days are partly mirage—and this includes key indicators such as gross national product, profits, sales and personal income. Make adjustments for inflation and it's clear business is holding steady at a high level. Not much more than that.

The FRB index of industrial production points up this trend. Since the index measures real output in manufacturing and mining, it is not affected by price changes. The May figure was 143, as compared with 144 for April and a steady 146 for January, February, and March. Thus, while some industries—aircraft, office machinery, electrical apparatus—have increased output, the overall index has sideslipped a bit in the past few months.

And take a second look at recent estimates of personal income. Last week, the Dept of Commerce announced a record annual rate of $340.5 billion for May, up $17.5 billion from a year ago. But, adjusted for rising prices and population growth, it turns out that real per capita income is just holding even, not increasing.

There's a good chance this situation will change for the better in the next six months, however. Many signs point to a let-up in inflation but a pick-up in production, particularly in the fourth quarter of '57. This means more dollar records on the books—but with a new twist. They may mean something.

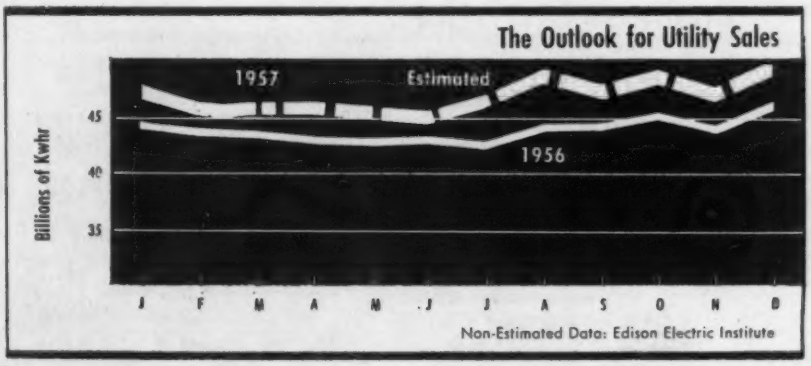
This optimistic tone is evident in utility plans. Electric, gas, telephone and other utilities are setting the pace in amounts invested in new plant and equipment, a recent Dept of Commerce-Securities and Exchange Commission survey shows.

Utilities plan to invest $6.42 billion in the third quarter this year—27% more than in the same quarter a year ago. In contrast to this outlay, industry as a whole is investing at a rate only 6% higher than 1956.

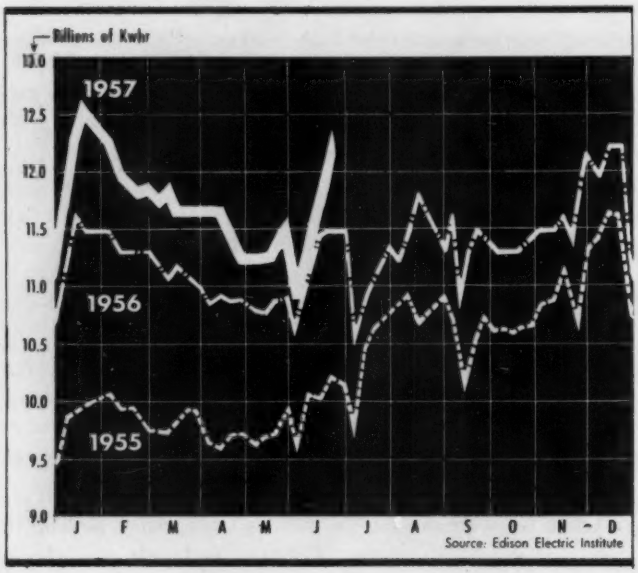
• • •

The squeeze on copper prices will tighten. London prices remain about 2¢ lb below domestic refined copper. But look for the copper industry to fight any cuts below the current U. S. price of 29¼¢. Output will continue to be shaved by vacation shutdowns or layoffs.

Trend of "bare-bone" inventories will continue. Few purchasing executives are trying to "beat" anticipated price advances, even for steel, reports National Assn of Purchasing Agents. Its latest survey explored today's dollar-for-dollar quality of materials compared with a few years ago. Fifty percent of NAPA members think materials are better; 30% see no difference.



STATISTICS



OUTPUT

Week ended June 22, 12,337,000,000 Kwhr Up 7.5%

Per Cent Change From Previous Year

	June 8	June 15	June 22
Total U. S.	+ 5.5	+4.7	+ 7.5
New Eng.	+ 3.9	+4.0	+ 8.3
Mid. Atlan.	+ 3.5	+3.3	+11.2
Cent. Ind.	+ 4.4	+1.2	+ 2.9
West Cent.	+ 6.5	+2.4	+ 0.1
Southeast	+ 8.9	+8.1	+10.9
South Cent.	+ 1.5	+9.3	+ 9.5
Rocky Mount.	+ 3.3	+1.5	+ 3.4
Pacific			
NW	+ 3.7	+6.8	+ 7.7
SW	+10.2	+6.3	+11.0

Seasonally Adjusted Index 235.5
Week Ago 231.3
Year Ago 219.8

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 8.1%.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	April	122.27	121.78	116.78	4.7
Peak—Class 1 Systems (million kw)	April	97.7	98.0	91.6	6.7
Estimated Dec. '57 Peak	April	113.6	113.5	114.1	− 0.4
Production—billion kwhr	April	50.67	52.45	47.49	6.7
Hydro		12.05	11.44	11.55	4.3
Fuel		38.62	41.01	35.94	7.5
Sales—billion kwhr	Mar.	47.75	47.78	45.36	5.3
Residential		13.47	14.25	12.46	8.1
Commercial		7.35	7.49	6.84	7.5
Industrial		24.44	23.65	23.70	3.1
Other		2.49	2.40	2.35	6.0
Fuel Consumption	April				
Coal—million tons		12.50	13.84	11.95	4.6
Oil—million barrels		6.47	6.57	5.76	12.3
Gas—billion cu ft		98.80	93.15	89.72	10.1
Net Income Class A & B Co's—$ million	Mar.	126.81	142.34	116.86	8.5
Residential Customers—millions	12 mos.	45.99	45.92	44.67	3.0
Revenue per kwhr	ended	2.59¢	2.59¢	2.63¢	− 1.5
Avg kwhr per customer	Mar. 31	3,021	3,004	2,820	7.1
Avg annual bill		$78.23	$77.80	$74.17	5.5

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	May	143	144	141	1.4
ENR Construction Cost	June	151.2	150	145.1	4.2
BLS Cost-of-living	May	119.6	119.3	115.4	3.6
New Orders for Machinery (1950 = 100)	April	147	159	149	− 1.3
NEMA Sales					
Insulation materials	April	145	153	163	−11.0
Electric appliances		83	97	111	−25.2
Wholesale prices	April				
Motors and generators		141.4	140.7	130.4	8.4
Transformers and regulators		147.4	147.4	135.3	8.9
Switchgear and fuses		164.4	164.4	149.0	10.3
GNP—annual rate—$ billion	1st Qtr.	427.0	423.8	403.4	5.9%

MANAGEMENT BULLETIN

FINANCE

Electric companies floated only $35 million in new bonds last week. The first was a $15 million Delaware Power & Light Co first mtg 5% bonds (Aa) due 1987 which was won by a group headed by White, Weld & Co and Shields & Co with a bid of 100.1899%. They were reoffered at 101.375% to yield 4.91% . . . Halsey Stuart & Co and Lehman Brothers group won $20 million Puget Sound Power & Light Co first mtg 6¼% bonds (Baa) due 1987 with a bid of 101.559%; reoffered at 103.459% to yield 6%. Earlier the Federal Power Commission had denied the Puget Sound P&L request to issue non-callable bonds. The commission said it believes it to be in the public interest, in the case of a regulated industry, that the hire of money be stated in such a manner as to allow the debtor to take advantage of any future fortuitous market conditions which might result in lower annual cost of money to it.

Future Financing: Virginia Electric & Power Co will sell competitively $20 million first mtg bonds on December 3 . . . Sacramento, Calif., Municipal Utility District will sell up to $10 million revenue bonds.

"All sold immediately" was the comment of Blyth & Co after it had offered $10 million Montana-Dakato Utilities Co. 4⅞% debentures (Ba) due 1977 at 101% to yield 4.80%. Earlier the Blyth group had won the bonds with a bid of 99.11%.

Electric companies, says John Childs, vp of Irving Trust Co, have completed "a little more than half of their 1957 program in selling $1,260,000,000 new issues. To raise this money they sold $805 million bonds, or 64% of the financing. This is in the same proportion as in 1956. Preferred stock sales have been far below those of previous years. Sales of common stocks accounted for 30% of the total financing."

In this period of climbing interest rates, Childs warns, companies should be careful of the limits they file on the coupon rate which can be accepted on an issue. Michigan-Wisconsin Pipe Line issue caused some confusion when a coupon rate of 6¼% was received on the bidding and only a 6% rate had been authorized on the issue.

Regarding future financing, Childs points out, that there will be some let up in the flood of new issues during August. The heavy pace of new financing will pick up again in September and October.

Increased dividend: Montana Power Co will pay July 29 a quarterly common stock dividend of 50¢ a share as compared with 45¢ previously.

After trading restrictions were lifted on Northern States Power's $10 million first mtg 4⅝% bonds which were offered at par, the bonds traded down to 97 bid, 97½ asked.

REGULATION

Columbus & Southern Ohio Electric Co asks PUC for authority to revise its regulations governing service. Here are some of them:

1. Reduce from 20 to 10 days the period which may lapse for the non-payment of bills when the company could suspend service.

2. Change the charge which the company could assess for trips to collect overdue bills. At present a charge can be made for such trips only if there is more than one unpaid bill in a 12-month period. Under the new regulation, the company proposes that it be authorized to make a charge for any trip to collect a bill, that the charge be commensurate with the cost of such trip, but less than $2.

3. Eliminate the seasonal customers as "temporary" when no energy is consumed during the off-season. Company contends that the temporary customers are carried at a loss, since the company must retain the service facilities which

have been bringing no return to the company to date.

4. Permit suspension of service if company representatives are prevented from safely reading meters.

RATES

Los Angeles, Calif., electric customers may soon be paying higher rates. Municipal Board of Water and Power Commissioners of Los Angeles Department of Water & Power plans to petition City Council for approval to increase rates about $6 million a year.

New irrigation rate in Alabama. Alabama Power Co put in a special rate for irrigation pumping service between 8 PM and 7 AM Monday through Friday and any hours on Saturday and Sunday, provided a total use during peak hours does not exceed 10% of the total. Charges: 1¢ a kwhr for energy used during those periods and 5¢ a kwhr at other times with $100 a month minimum.

Tacoma City Council will soon get a proposal from City Light to up rates. This was revealed recently when the Council gave approval of a sale of $5 million of City Light bonds at a net interest rate of 4.291%. One Council member asked Utilities Director Dean Barline how he could justify borrowing "at that kind of an interest rate." Barline replied that money was needed for expansion. "Do we have to expand," asked the Council member. "We do, unless we want the lights to go out next winter and unless we want to tell the people not to buy anymore TV sets and washing machines," answered Barline. He also added that he knew of no utility in the country which is operated debt free.

Ohio Edison Co files an appeal with PUC from an electric rate ordinance passed at Mansfield, fixing rates for residential, secondary light and power, and street lighting services. Company says rates "are unjust, unreasonable, and insufficient to yield reasonable compensation for the service to be rendered."

Niagara Mohawk Power Corp is being sued for alleged overcharges totaling $931,570 by the Vanadium Corp of America. It covers the period from June 7, 1956 to May 31, 1957. Complaint alleges that Niagara Mohawk made changes in its rates after June 7, 1956 without filing them with the PSC.

COURT RULING

Pennsylvania Court of Common Pleas of Dauphin County has ruled that a company organized for the purpose of generating and transmitting electricity has the right to appropriate property for the purpose of dumping ashes produced at generating plants.

ACQUISITIONS

Roanoke Island, N. C., will now get power from Virginia Electric & Power Co. Vepco reported in March that it had finished negotiations for the purchase of Roanoke Utilities Co, Manteo, N. C. But the Manteo Town Council has now eliminated the final hurdle when it granted the company a 30-year franchise.

CONSTRUCTION

Expenditures of privately-owned electric companies will peak out in 1958, Lionel D. Edie & Co reports in a special memo. These companies are expected to spend $3,970 million in 1957; $4,020 million in 1958; $3,630 million in 1959; $3,700 million in 1960, and $3,560 million in 1961. The memo goes on to say "that taking into account the fact that there is a tendency to underestimate long-term capital expendiure plans, it is more likely that capital expenditures will continue upward until 1961 at least."

FRANCHISE

Houston, Tex., citizens will vote July 27 on whether or not to give a 50-year franchise to Houston Lighting & Power Co to serve the city. New franchise, if granted, will increase annual gross receipts paid to the city from 2% at present to 4% of gross revenues.

MEETINGS CALENDAR

JULY

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, July 18.

Southeastern Electric Exchange—Personnel Administration Section Conference, John Marshall Hotel, Richmond, Va., July 25-26.

AUGUST

Western Electronic Show and Convention—Annual Meeting, Cow Palace, San Francisco, Calif., August 20-23.

American Institute of Electrical Engineers—Pacific General Meeting, Yakima, Washington, Aug. 26-30.

SEPTEMBER

American Institute of Electrical Engineers—2nd Special Technical Conference and Exhibit on Magnetic Amplifiers, Hotel Penn Sheraton, Pittsburgh, Pennsylvania, September 4-6; Sixth Annual Industrial Electronics Symposium, co-sponsored with Institute of Radio Engineers, Morrison Hotel, Chicago, Ill., Sept. 24-25.

Instrument Society of America—12th Annual Instrument Automation Conference and Exhibit, Cleveland Auditorium, Cleveland, Ohio, Sept. 9-13.

Illuminating Engineering Society—National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Maryland Utilities Association—33rd Annual Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 13-14.

Edison Electric Institute—Accounting Division Organization Meeting, jointly with AGA, Lemington Hotel, Minneapolis, Minn., Sept. 19-20; Industrial Relations 10th Annual Round Table Conference, Drake Hotel, Chicago, Ill., Sept. 23-25; Meter & Service Committee, Hotel Nicolet, Minneapolis, Sept. 23-25; Electrical Systems and Equipment Committee, Cosmopolitan Hotel, Denver, Colo., Sept. 30-Oct. 1.

Public Utilities Association of the Virginias—39th Annual Meeting, White Sulphur Springs, West Virginia, Sept. 19-21.

American Society of Mechanical Engineers—Fall Meeting, Statler Hotel, Hartford, Conn., Sept. 23-25.

Electric Companies Advertising Program—Copy Group Meeting, Detroit, Mich., Sept. 25.

• **Electric Companies Public Information Program**—Steering Committee, New York City, Sept. 11; Workshop Conference, Whittier Hotel, Detroit, Mich., Sept. 25-27.

OCTOBER

Pennsylvania Electric Association—50th Annual Meeting, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 2-3.

Indiana Electric Association—French Lick-Sheraton Hotel, French Lick, Ind., Oct. 2-4.

International Association of Electrical Leagues—Annual Conference, Sheraton-Gibson Hotel, Cincinnati, Ohio, October 2-5.

National Industrial Conference Board—Atomic Energy Course for Management, Hotel Moraine on the Lake, Highland Park, Ill., Oct. 6-12.

American Society of Mechanical Engineers—Lubrication Conference, sponsored jointly with American Society of Lubrication Engineers, Royal York Hotel, Toronto, Canada, Oct. 7-9; Power Conference, Americus Hotel, Allentown, Pa., Oct. 21-23.

National Electronics Conference, Inc—Hotel Sherman, Chicago, Ill., Oct. 7-9.

American Institute of Electrical Engineers—Fall General Meeting, Morrison Hotel, Chicago, Illinois, October 7-11.

Edison Electric Institute—Area Development Workshop, Phoenix Hotel, Lexington, Ky., Oct. 9-11; Transmission & Distribution Committee, Statler Hotel, Boston, Massachusetts, October 17-18; Accounting Division Taxation Accounting Committee, held jointly with AGA, Williamsburg, Va., Oct. 23-24.

• **Rocky Mountain Electric League**—54th Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., Oct. 13-17.

Interstate Power Club—Hotel Martinique, New York City, N. Y., October 14.

• **Oklahoma Utilities Association**—Electric Light and Power Division, Western District, Woodward, Okla., Oct. 24; Eastern District, Bartlesville, Okla., Oct. 25.

Atomic Industrial Forum—Annual Conference, New York City, Oct. 28-30.

American Nuclear Society—Winter Meeting, New York City, Oct. 28-30.

National Association of Railroad Utilities Commissioners—Annual Conference, Peabody Hotel, Memphis, Tennessee, October 28-31.

Industrial Management Society—21st Anniversary Industrial and Management Clinic, Hotel Sherman, Chicago, Ill., Oct. 30-Nov. 1.

Institute of Radio Engineers—3rd Annual Technical Conference of the Professional Group on Electron Devices, Shoreham Hotel, Washington, D. C., Oct. 31-Nov. 1.

NOVEMBER

Edison Electric Institute—Accident Prevention Committee, Penn-Sheraton Hotel, Pittsburgh, Pa., Nov. 6-8.

Pacific Coast Electrical Association—Hawaiian Conference, Reef Hotel, Honolulu, Hawaii, Nov. 7-8.

Institute of Radio Engineers—Third Annual Instrumentation Conference, Atlanta Biltmore Hotel, Atlanta, Georgia, Nov. 11-13.

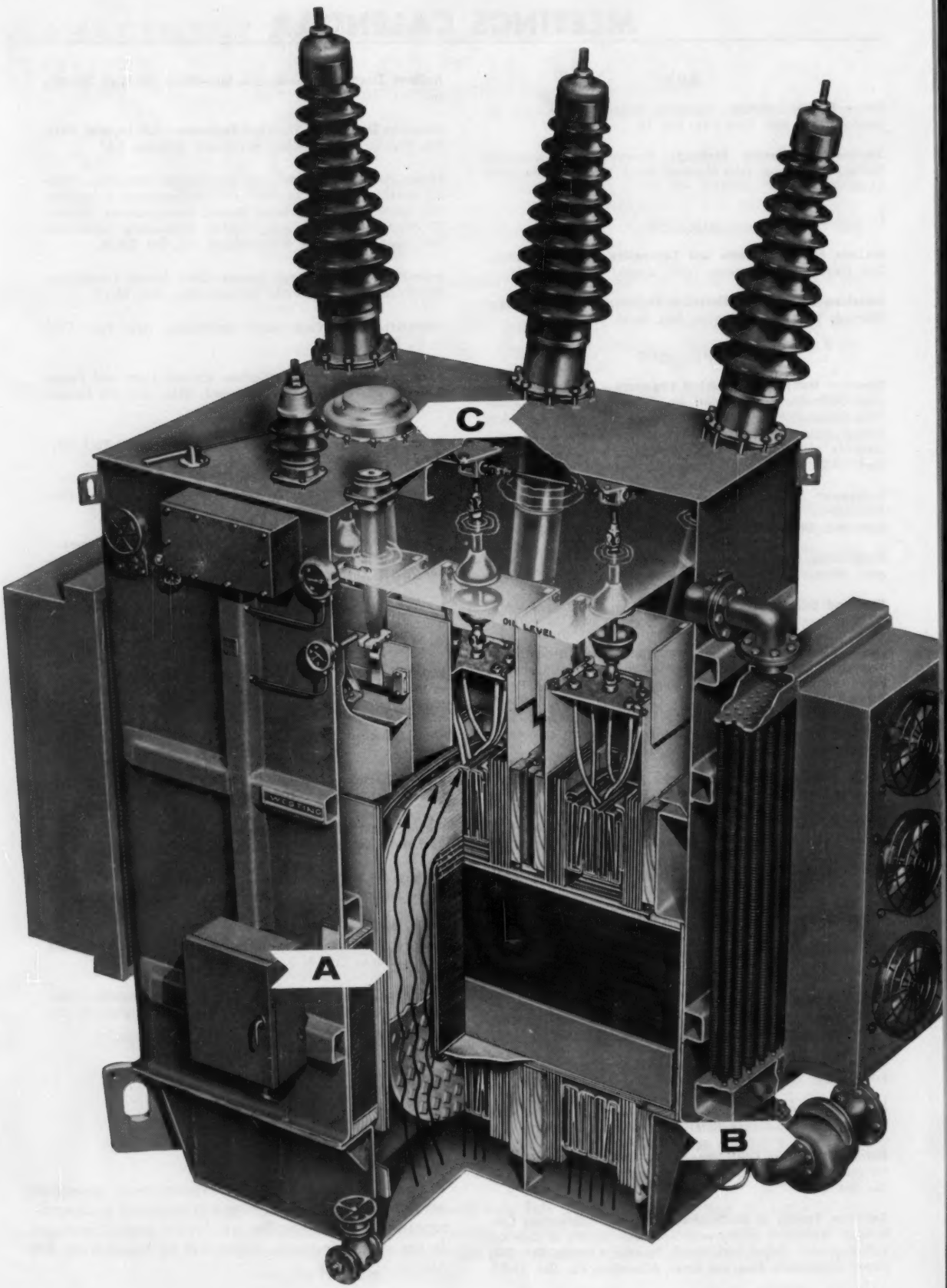
National Electrical Manufacturers Association—Traymore Hotel, Atlantic City, N. J., Nov. 11-15.

• **Electric Companies Public Information Program**—Inter-Regional Committee, Mayflower Hotel, Washington, D. C., Nov. 19.

• Additions this week.

Tripling Steam Plant Set

The $50-million Richard L. Hearn steam generating plant on Toronto's waterfront will be tripled in capacity, reports A. W. Manby, Ontario Hydro general manager. In the next four years, output will be raised from 400 Mw to 1,200 Mw.


C
OIL LEVEL
A
B

How Westinghouse safely* saved the electric utility industry $100,000,000!

Today, over 80 million kva of Westinghouse forced-oil-cooled transformers are delivering superior performance

In 1922, Westinghouse pioneered forced-oil cooling for power transformers. Since then, its inherent economies have saved electric utilities over $100,000,000. Here's why *you* get more transformer per dollar with Westinghouse . . .

A—*SUPERIOR COOLING ARRANGEMENT*

Form-Fit® design directs oil circulation to *all* parts of the winding. No special ducts or baffles. Rectangular-shaped coils placed vertically in the tank form long, vertical oil ducts. Oil is in direct contact with both sides of each coil. Hot-spot temperatures are reduced, service life extended and overload capacity increased.

B—*LOW-PRESSURE, HIGH-VOLUME OIL FLOW PROVIDED BY PUMPS*

Extremely low pressure and temperature differentials in the Westinghouse system of forced-oil cooling result in increased transformer life. The many parallel vertical ducts in the winding and cooler have exceptionally low-pressure drop even when large volume of oil is circulated by the low-head centrifugal pumps. With high-volume forced-oil cooling the difference between top and bottom oil temperature is held to a minimum with resultant low hot-spot temperatures.

C—*POSITIVE OIL PRESERVATION*

A completely sealed, inert gas system is recommended to keep moisture and atmospheric oxygen out and keep oil clean indefinitely. Maintenance costs are kept down—way down.

*Two proved gas systems are available—Inertaire® which maintains positive pressure at all times and Sealedaire†; both are sealed for complete protection.

For the full story of how Westinghouse power transformers with forced-oil cooling can save you money—in longer service life, lower maintenance and extra overload capacity—call your Westinghouse representative. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70816

†Trade-Mark

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Save on Installation and Maintenance Costs

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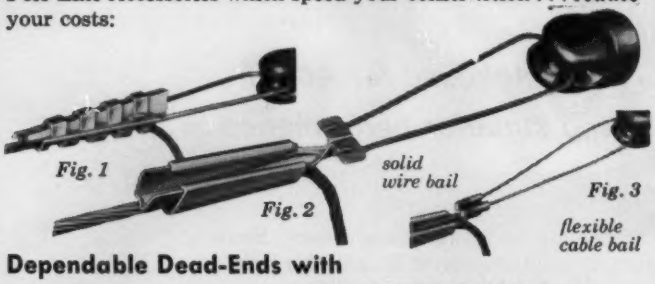

Dependable Dead-Ends with WEDGE-TITE CLAMPS

Simple, economical . . . for bare neutral self-supporting service cable. Develop high holding strength to safely support span. One-piece clamps (Fig. 1) are constructed so parts can't become separated during installation. Time-saving two-piece clamps (Fig. 2 and 3) do not require neutral to be threaded through clamp.

Neat, Compact LAY-CIT CABLE GRIPS

For aerial and service cable. Double-gripping action of aluminum Lay-Cit plates and extra holding power of their knurled inner surfaces make this clamp particularly efficient on modern synthetic-jacketed cables.

Simple, Inexpensive SPAN CLAMPS

Dead-end service wire to bare neutral of secondary in mid-span. To install, slip clamp on secondary neutral, tighten single bolt.

Easily Installed SERVICE CABLE TIES

Secure insulated wires to bare neutral, preventing separation of conductors. Soft aluminum; install with fingers.

354

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CATALOGS—BULLETINS

• **WHEEL DITCHER:** An 8-page folder describes the Model 774 wheel-type ditcher manufactured by Barber-Greene Co, 400 North Highland Ave, Aurora, Ill.

• **INDUSTRIAL OVENS & DRYERS:** Bulletin 157, 16 pages, illustrates and describes the complete line of industrial ovens for baking, drying, curing and testing made by Young Brothers Co, 1831 Columbus Road, Cleveland 13, Ohio.

• **AIR CIRCUIT BREAKERS:** Hope Electrical Products Co, 32 Long Ave, Hillside, N. J., has issued a bulletin describing its enclosed (NEMA IV, VII) Cordon-type (ITE Circuit Breaker Co) current-limiting air circuit breakers.

• **FLUORESCENT LIGHTING UNITS:** Four folders have been published by Smithcraft Lighting, Chelsea, Mass. They cover the company's "Twosome," "Civic," "Executive," and "Freeway" fluorescent units.

• **BUTYL RUBBER:** A 16-page booklet covering the resistance of Butyl rubber to various solvents and chemicals has been issued by Thiokol Chemical Corp, 780 N. Clinton Ave, Trenton 7, N. J.

• **STOKERS:** A 12-page bulletin covering its line of Lo-Set Ramfeed Stokers has been made available by Canton Stoker Corp, 300 Andrews Place, S. W., Canton 1, Ohio.

• **INSTRUMENTS & CONTROLS:** A digest of instruments and controls manufactured by Hays Corp has become available from the company. Write the company at Michigan City, Indiana.

• **STEEL PIPE & TUBING:** Bulletins 145 and 152 discuss B&W Croloy tubing in applications involving elevated temperatures and pressures. Copies may be obtained from Babcock & Wilcox Co, Tubular Products Div, Beaver Falls, Pa.

• **RECORDER:** An 8-page data sheet, No. 463-162, presents typical curves obtainable by the Speedomax Four-Mill Temperature Recorder-Controller made by Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa.

• **LINE CONSTRUCTION EQUIPMENT:** The line construction equipment made by Peterson Engineering Co, Inc, is covered in considerable detail in a binder-type publication recently issued by the company. Write to Peterson Engineering Co, Inc, Santa Clara, Calif.

• **ALUMINUM JOINT PROTECTION:** How a lineman can apply protective compound "Penetrox A" to electrical connections involving aluminum without soiling his hands or gloves is pictured in folder issued by Burndy Corp, Norwalk, Conn.

• **MECHANICAL SEALS:** A brochure covers the boiler feed pump mechanical seals available from Crane Packing Co, Morton Grove, Ill.

• **DISTRIBUTION TRANSFORMERS:** A 16-page bulletin, "Distribution transformers for Rural and Industrial Substations," (75 through 500 kva, 67 kv and below, single phase), has been released by A-C. Ask for Bulletin 61B6014C from Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

Economic A-Power

(*Continued from page 57*)

nuclear fuel. Ceramic fuel elements also raise the prospect of making fuel elements without cladding.

Fuel elements of this type are now being tested in the Borax-4 reactor at Argonne National Laboratory (EW May 20, 1957, p 20). Each element is in the form of ceramic pellets of uranium-thorium oxide. Outlet temperature of this reactor is 419F at 300 psi. The various fuel elements show good resistance to corrosion in either water or NaK.

Research activity is intense at various AEC facilities seeking to produce a uranium alloy that will be dimensionally stable and stand up under radiation and high temperatures. Major trouble with uranium alone is its distortion under heating or cooling. It is also susceptible to radiation creep, a sagging of the metal under its own weight when exposed to radiation. This distortion is not evident in ceramic fuel elements.

The alloying possibilities of uranium with virtually everything in the periodic table are being investigated at all AEC facilities. Niobium, molybdenum, silicon, and zirconium are among the materials frequently mentioned.

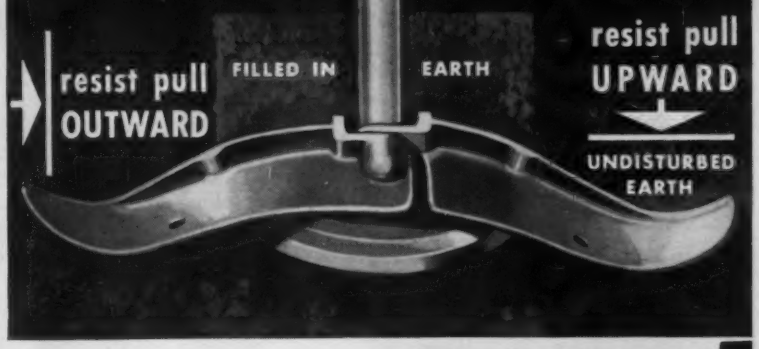
CIPSCO to Expand Plant

Central Illinois Public Service Co plans to begin installation early next year of a 200,000-kw generating unit at its Meredosia station. The unit, in addition to a 100,000-kw facility scheduled for operation this year, will boost the company's capacity to 775,000-kw when it goes on the line in 1960.

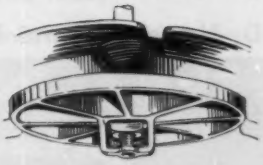
Austria Tests Line to Italy

Austria has connected her nationwide grid system to the North Italian "SADE" network to test the new line from Lienz, Austria, to Pelos, Italy. Italy is the second European country to be hooked to the Austrian system. A direct line between Austria and West Germany has existed for two years.

KEARNEY EXPANSION Develop *Full* MALLEABLE IRON ANCHORS Holding Power



You can depend on KEARNEY Expansion Anchors to develop published holding power! Blade contour is specially designed and engineered to provide extra holding power right where it's needed most—by resisting pull outward against the earth as well as upward. 63% of the expanded blade area lies securely under undisturbed earth because the blades expand easily without disturbing surrounding earth. Anchor discs, against which the expanded blades *lock*, are rugged, heavily reinforced. KEARNEY Expansion Anchors are available in 2, 3 and 4 blade types . . . and they're easy to install!



Rod can't slide through disc because recessed disc socket retains nut, enables rod to be easily salvaged.

355

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Okonite Co Dedicates New Plant

Equipment and men were transferred from Wilkes-Barre to North Brunswick which has room for 50% more expansion

Now in operation is Okonite Co's new manufacturing facility in North Brunswick, N. J. Dedicated in mid-June, the plant was in production one year after possession was taken in May, 1956, noted R. Stuart Keefer, president.

Purchased for $4.2 million, the former Studebaker proposed assembly plant property contains 160 acres. The main plant is 1400 ft long and 360 ft at its widest point with space in all buildings totaling 446,000 sq ft.

Unexpected availability of this modern unused property hastened the decision to close the Wilkes-Barre, Pa., plant. Equipment amounting to a total of 266 freight-car loads, along with approximately $2 million new investment, furnish the plant. Equipment will be moved also from the Passaic and Patterson factories to relieve congestion and to further increase the production of the North Brunswick plant which has room for 50% more expansion.

The plant produces rubber and plastic-insulated wires and cables for power, control, and communication purposes. When operating at full capacity, it will add about 20% to the manufacturing facilities.

An unusual feature is a centrally located electrical testing department which tests materials and finished products. Tests are made in four fence-enclosed tanks 16 ft deep.

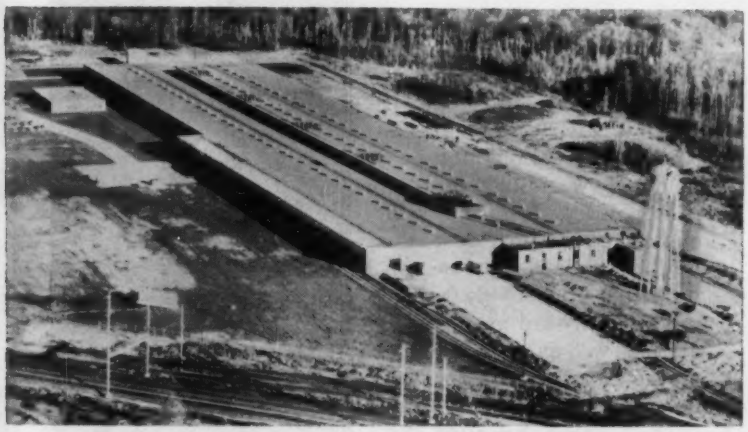
Materials in rubber compound and lead departments are weighed in buckets on a traveling scale and delivered on the 360-ft conveyor to the Banbury mixers. Future plans call for silo storage tanks so raw materials can be purchased in bulk.

Shipping facilities include four railroad sidings on the property. Enclosed within the plant is an all-weather siding capable of handling nine freight cars. Also there are nine truck docks for floor-level loading.

Plant's electrical system is supplied through a main sub-station served by two 26.4-kv circuits, one being a standby line, from the Public Service Electric & Gas Co. There it is transformed and distributed to mezzanine substations at 13.2 kv. The original transformer was capable of handling 6,000 kva. As the largest of many plant motors is a 300-600 hp synchronous motor serving No. 11 Banbury, it was necessary to install a 5,000-kva transformer for the 4,160-v system. Distribution is at 440 v.

Distribution cables for 13.2 kv are 3-conductor 350,000-cm paper-insulated, lead-covered, and duct installed. The 5,000-v cables are non-shielded Okolite-Okoprene. The 600-v control cables are Okolite-Okoprene, both single and multiple conductor styles.

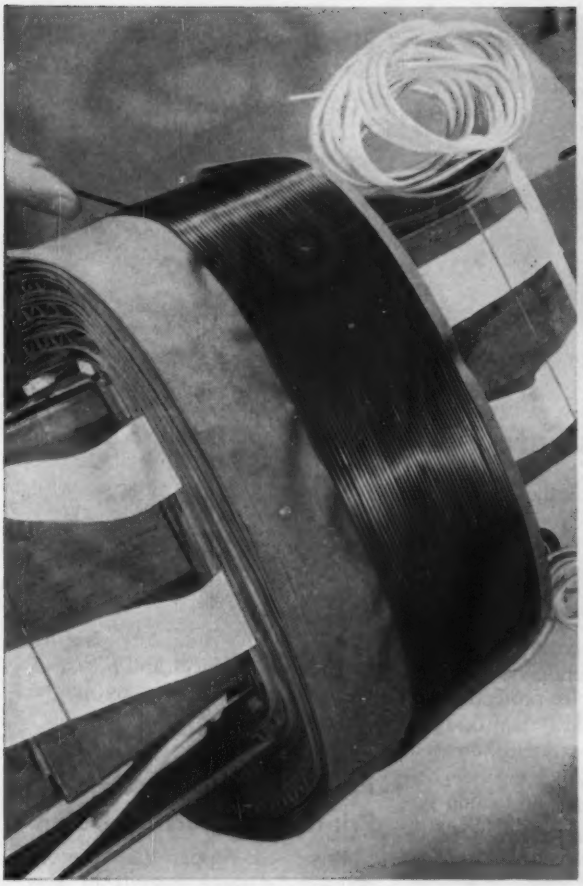
Of the personnel employed at the Wilkes-Barre plant, 375 or 68.7% relocated to the North Brunswick factory. The entire engineering force and over 90% of the foreman and supervisors made the move.

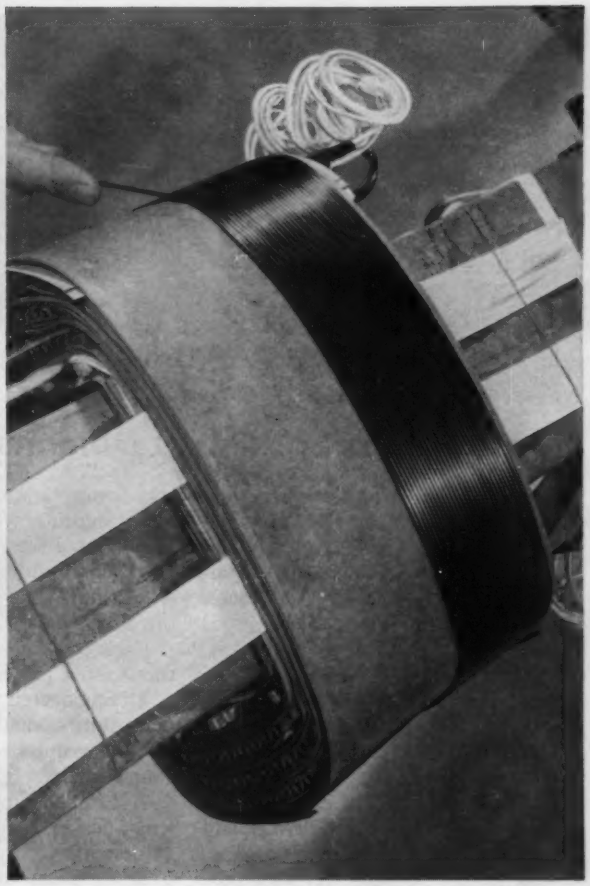


Okonite's North Brunswick plant inspected by . . .

. . . D. Nurse, vp, and D. McParlin, plant engineer

(*More M & M on page* 98)





KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift.

"What's different about these transformer coils . . . . ?"

"Although at first glance the two distribution transformer coils shown above may look identical—*there is a significant difference.*

"The coil on the left is being wound with too much wire tension. The pressure on the wire is developing wrinkles or weak spots on the insulation's surface. At the right, the winder demonstrates how a Kuhlman coil is wound so that wire fits snug without crushing the insulation.

"Laboratory tests prove that this difference in coil winding control greatly increases the coil's ability to withstand electrical surges and the harmful effects of aging. Obviously Kuhlman coils offer greater dependability and longer life.

"Here is an example of how Kuhlman research and quality control work together to assure you that when it's made by Kuhlman — *there is a difference.*"

5714b

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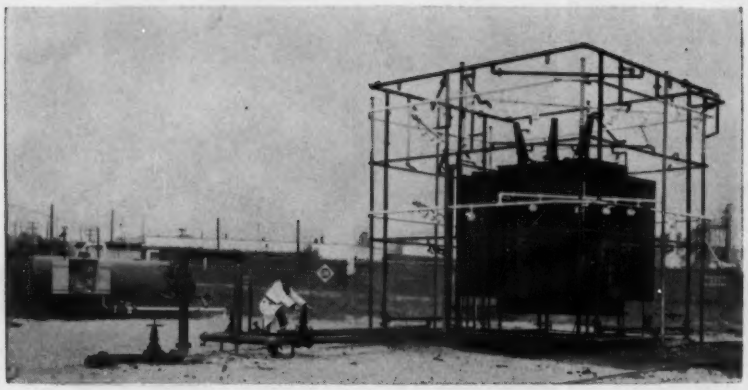


Transformer Sprinklers Demonstrated

A transformer protection evaluation program including demonstration on actual transformer fires has been started by "Automatic" Sprinkler Corp of America at its main plant at Youngstown, Ohio. It is designed for personnel of utilities, industrial firms, insurance companies, and consulting engineers.

Purpose of the program is to provide information as to types of protection systems available and performance expected of each, to give a background for specifying and purchasing fire protection.

A feature of each day-long program is demonstrations conducted on a full-scale model of a 20 Mva transformer, piped to provide CO_2 and water spray from several commercially-available layouts as shown in picture above. The test facility compares performance of systems on fires in five different locations. The locations are—top of transformer around the bushings, at lower position of sides of transformer (one simulating a spill fire), between transformer case and back of radiators, and between two rows of radiators.

Each program covers three basic transformer protection systems:

1. Engineered fire protection system—an automatic system designed to obtain quick extinguishment or control of fire.
2. Limited supply protection system—designed for positive extinguishment.
3. Auxiliary to hose station system—a fixed-piping system, manually or automatically-operated.

Included in the program also are discussions and films of dry chemical systems, and demonstrations of auxiliaries such as rate-of-rise detection equipment. A program will be conducted each week throughout the summer and autumn.

Westinghouse Installs Compressed-Air Breaker

A dead-tank, high-capacity, outdoor, compressed-air circuit breaker, built by Westinghouse Electric Corp, has been installed in the Jamaica Station of Consolidated Edison Co. It is a 138-kv breaker with a normal current rating of 1600 amp and an interrupting rating of 10 million kva. (EW, Nov. 26, 1956, p 166).

With 21 identical units to be delivered to Consolidated Edison Co during 1957-58, some will be designed to accommodate 138-kv isolated phase bus gear. These are said to be the first installations of this type in the country. The new compressed-air breaker was shipped completely assembled, and is mounted on the same foundation as equivalent oil-filled breakers.

112-Kva Distribution Unit

An indoor distribution center rated 112.5 kva, 3-phase, 4160-208 Y/120 v has been made available by Standard Transformer Co, Warren, Ohio. This unit is shipped in one piece and requires no vault. It has separate incoming line and feeder sections and a dry transformer.

Sangamo Prices Increased on Meters, Transformers

Sangamo Electric Co, Springfield, Ill., has increased prices on its a-c and d-c meters and instrument transformers.

The increase in price of 1.79% on a-c watt-hour metering equipment is effective July 1. On all orders received prior to July 1 and shipped before Oct. 1, billing will be at the previous price.

Adjustments are being made on d-c metering equipment.

Instrument transformer prices are being increased effective July 1 approximately 10%. On orders placed before July 1 and shipped before Dec. 31, billing will be at the previous price.

Sangamo's price adjustment is in accordance with its previously announced policy of advising the industry 15 days prior to each calendar quarter of prices and policies to be in effect for the coming quarter.

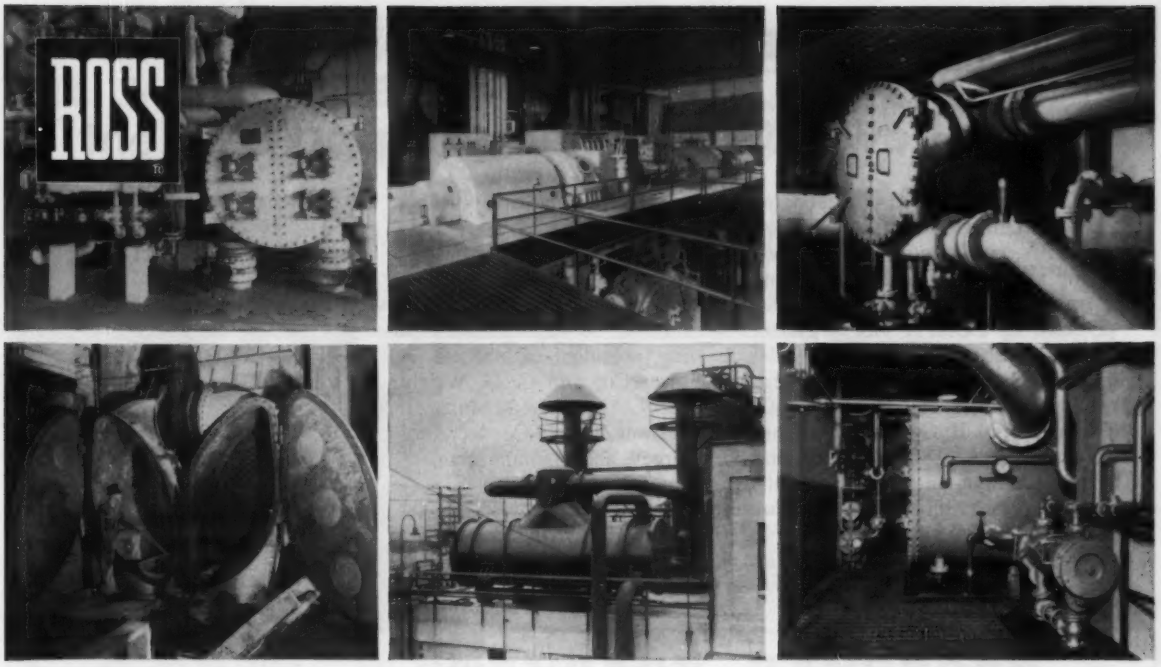
Processed Copper Up, Primary Production Down

Processed copper quantities increased for three records in May, although the primary production decreased. Primary copper production in the U.S. totalled 96,000 tons in May, according to the Copper Institute, New York. This quantity is about 2,900 tons less than the April amount.

Refined copper production for May was 151,045 tons. In addition to being an increase of 7,032 tons over the preceding month, it was a record high for the first five months of 1957. Deliveries to fabricators totalled 120,351 tons in May, up 3,645 tons over April and another "high" for the month. Refined stocks at the end of May totaled 155,365 tons. This amount is 15,523 tons more than at the end of April and the third record for the month of May.

Folder Simulates Container

Burndy Corp, Norwalk, Conn., has issued a folder in the shape of a polyethylene squeeze bottle to describe the application of the company's Penetrox.



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Pertinent facts on Ross leadership in surface condenser design are available in Bulletins 8.1K1 and 8.2K1. Write for your copies. Ross Heat Exchanger Division of American-Standard, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Toronto 5, Ont.

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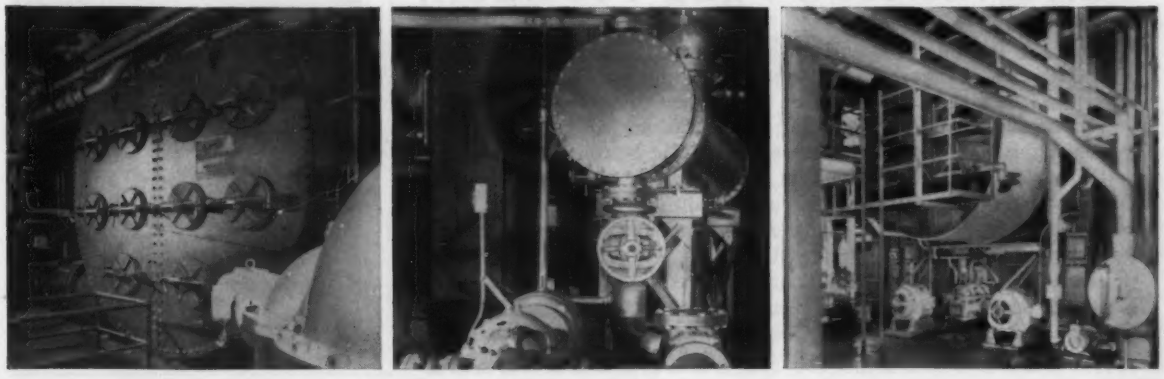
Division of AMERICAN-Standard



NEWS ABOUT PEOPLE

Atomic Power Group Elects Kapp President

M. L. Kapp, president of Interstate Power Co, has been elected president of Central Utilities Atomic Power Associates.

CUAPA, composed of 11 midwest utilities, was recently organized to develop and build a 66,000-kw atomic fueled electric generating plant in the southwestern part of Northern States Power Co's system.

Elected as CUAPA vice presidents were H. P. Taylor, president of Wisconsin Public Service Corp; Allen S. King, president of NSP; C. A. Semrad, president of St. Joseph Light & Power Co; and C. G. Wright, president of Otter Tail Power Co. Other officers of the new organization are treasurer, N. B. Gussett, president of Iowa Power & Light Co; secretary-assistant treasurer, Donald E. Nelson, NSP attorney; and assistant secretary, Carl A. Hummel, Interstate's executive vice president.

Kapp, whose utility career dates back to 1918, has been Interstate president since 1953. Since joining Interstate in 1939, he has been assistant to the president, vice president, and executive vice president. He became president of North Central Electric Assn in 1955.

M. L. KAPP

Tucson Utility Names Davis VP

The Tucson Gas, Electric Light & Power Co of Tucson, Ariz., has announced the recent election of J. Luther Davis as vice president of the utility.

The new vice president most recently served as assistant to Pres J. R. Snider, a position to which he was appointed in November of 1955.

Davis, a graduate of the University of Arizona, holds a BS degree in business administration and an LLB. He was engaged in private law practice in Tucson before his appointment as Tucson city manager in 1953. He has been associated with Tucson Gas, Electric Light & Power since July, 1955.

J. LUTHER DAVIS

Barrett is New AIEE President

American Institute of Electrical Engineers, at its recent annual meeting, elected Walter J. Barrett as 1957-58 president. Barrett, AIEE treasurer since 1953, is with New Jersey Bell Telephone Co.

The organization's five new vice presidents are Orien A. Gustafson, manager, installation-service engineering, Pacific Northwest district, General Electric Co; Albert G. Johnson, chief engineer, Omaha Public Power District; Herbert W. Oetinger, executive assistant, Duke Power Co; Benjamin R. Teare, Jr., dean of engineering and science, Carnegie Institute ot Technology; and Gordon F. Tracy, University of Toronto.

Elected as directors were William R. Clark, Leeds & Northrup Co; Edwin W. Morris, Westinghouse Electric Corp; and Julius C. Strasbourger, Cleveland Electric Illuminating Co. L. F. Hickernell, chief engineer of Anaconda Wire & Cable Co, is new treasurer.

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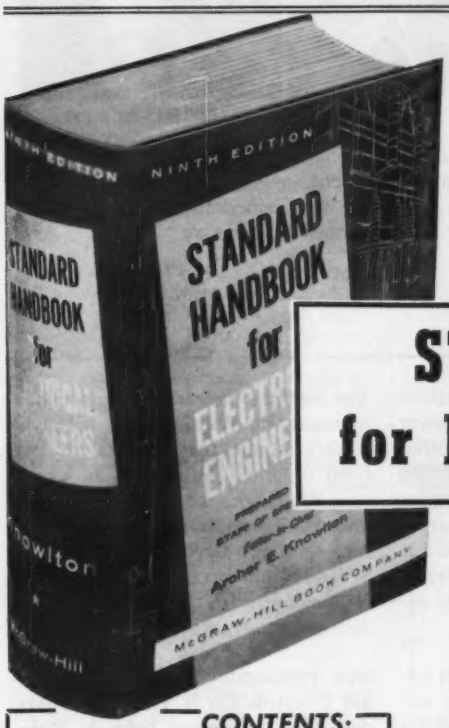

FOR years, leaders in the electrical engineering field have looked to this book as the authoritative reference that serves their every need. They've found it an encyclopedia of facts, figures, definitions, conversion factors, principles, accepted formulas, experimental data, etc. The most frequently required fundamental theories are covered just as thoroughly as recent developments and practices in every major area of electrical engineering. You, too, will find it a compact, easy-to-use guide that answers your ordinary and out-of-the-ordinary questions. That's why over a quarter of a million users keep this book within easy reach.

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C&D Batteries Makes Top Executive Changes

New president of C & D Batteries, Inc, is John F. Rittenhouse, executive vice president since 1953. He replaces the late Leon A. Doughty, one of the two founders of the firm. Frank S. Carlile, C&D's other founder, has been elevated from vice president-treasurer to the new post of chairman of the board.

Elected as a vice president was Louis M. Eble, Jr, a director. In addition to his new duties he will continue to direct purchasing and the advertising and sales promotion activities for the company.

Rittenhouse has spent most of his business career with C&D. He joined the firm's engineering department soon after graduating from Drexel Institute of Technology. In 1943 he was named chief engineer and rose to vice president of engineering in 1950.

Eble, an industrial engineering graduate of Pennsylvania State College, came to C&D in 1949 as advertising manager and assistant to the vice pres in charge of sales.

JOHN E. RITTENHOUSE LOUIS M. EBLE, JR

In other executive changes, Stewart E. Doughty, son of the former president, was elected treasurer, and Thomas L. Caldwell was named to the new post of comptroller and continues as secretary.

PERSONAL BRIEFS

Thomas N. Ward, Jr, is new secretary and treasurer of Ohio Valley Electric Corp and its subsidiary Indiana-Kentucky Electric Corp. His appointment becomes effective August 1.

Public Service Electric & Gas Co's **George E. Wolsieffer, Jr,** is now commercial manager in the North Hudson commercial office. He replaces **William J. Downey,** recently named executive assistant, Hudson Division.

American Institute of Electrical Engineers has named **Donald A. Quarles,** Deputy Secretary of Defense, as an honorary member. He received his honorary membership certificate at AIEE's recent summer general meeting . . . Eight AIEE members have been raised to the grade of fellow. They are **George W. Baughman,** Westinghouse Air Brake Co; **Clifford A. Duke,** Tennessee Valley Authority; **John Grotzinger,** Goodyear Tire & Rubber Co; **Marshall McKoch,** vice president-electrical operations, Public Service Co of Colorado; **Carlisle K. Milner,** Ohio Bell Telephone Co; **Harold L. Rorden,** high-voltage practice engineer, American Gas & Electric Service Corp; **Clifford L. Sampson,** Northwestern Bell Telephone Co; and **Randall B. Shipley,** TVA.

Clarence S. Cole is new operations engineer of Niagara Mohawk Power Corp's Western Division. In other company changes, **Carl F. Reisig** was appointed general superintendent of the Niagara Falls area; **Alexander Graham** succeeds him as superintendent, stations operations; and **William F. Grauch** becomes assistant general superintendent.

Raymond A. Dewberry has been appointed electrical distribution engineer in Montana-Dakota Utilities Co's Minneapolis office.

Allis-Chalmers Terre Haute Works has designated **Benjamin Torrison** as superintendent of the production control department.

General Electric Co's newly formed relations and utilities department has as its manager **Lester H. Means** . . . Metallurgical products department has advanced **Howard W. Arnold** to manager of product planning and marketing research.

At Cornell-Dubilier Electric Corp, the Power Factor Capacitor Division has named **L. S. Billman** as chief engineer and **Robert Arany** as sales manager . . . Tobe Deutschmann Corp has promoted **John M. Glyn** and **Joseph R. Richmond** as assistants to sales manager **Tom Crawford.**

The newly created position of sales manager of Westinghouse Electric Corp's atomic fuel department has been assumed by **Victor J. Kropf** . . . Westinghouse has named **Gordon W. Howson** sales manager of its large lamp department . . . **John S. Kuney** has been elevated to purchasing agent for the company's new distribution transformer plant.

New president of Robertshaw-Fulton Controls Co is **Thomas T. Arden.** His predecessor **John A. Robertshaw,** becomes board chairman.

OBITUARY

Clifford E. Brock, 63, vice president of Kansas Power & Light Co, died recently after a long illness.

George C. Estill, 76, a former president of Florida Power & Light Co, died following a lingering illness.

Walter M. Hood, 71, who retired in 1951 as secretary-treasurer of Alabama Power Co, died in Birmingham after a short illness.

Henry W. Leland, 54, manager of media planning and research for the advertising and sales promotion department of General Electric Co's Apparatus and Sales Division, died suddenly in New York City.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co's Industries Group has designated Robert J. Dineen as manager of general industrial sales in the Cincinnati district office . . . At the Houston district office of the Industries Group, K. D. Malick was recently made manager of petroleum and chemical sales and L. H. Spargo became manager of general industrial sales.

Bakelite Co, a division of Union Carbide Corp, has named George L. Dougherty as a technical representative for the Extrusion Materials Division, Boston district office.

General Electric Co has appointed Edwin W. Kenefake as sales manager for power line carrier current equipment for the communication products department. He is former microwave sales manager for the department.

Graybar Electric Co has advanced Donald B. Peck to district appliance sales manager at Seattle, Wash. He will direct appliance sales in Washington, Oregon, Montana, northern Idaho, and Alaska . . . L. A. Haley has been appointed to manage the company's new office and warehouse in Beaumont, Tex.

Hubbard & Co has transferred George T. Brundrett to the Plano, Tex., sales office. In the Southwest Division, Hal M. Layton, Jr was named to cover southwest Louisiana and the Texas Gulf Coast; B. J. Williams, to portions of New Mexico, Texas, and Louisiana; and J. A. Wills, to Arkansas, Mississippi, and portions of Tennessee and Louisiana.

Line Material Industries has given new field assignments to Wilbur R. Coffin and Richard H. Shaffer. Coffin will be fibre products engineer in the North Central Division with headquarters in Minneapolis and Shaffer will replace Coffin as L-M representative and field engineer in western Minnesota, eastern North Dakota, and northeastern South Dakota. . . . Recently assigned field engineering positions in L-M's sales organization were Ivan H. Gulick, at Fort Wayne, Ind., for northeastern Indiana and northwestern Ohio; Lester Gurney, at New York City, for metropolitan New York and Long Island; K. Kevin Kearney, at Decatur, Ill., for southeastern Illinois; and Clifford Malm at Anchorage, Alaska, for all of Alaska north of Juneau.

Okonite Co has announced the appointments of Dewey A. White and J. G. Wicks as regional sales managers. White will have charge of the Birmingham, New Orleans, and Dallas districts; Wicks, the Philadelphia, Boston, Cincinnati, Syracuse, Detroit, Cleveland, and Pittsburgh offices.

Standard Transformer Co has appointed Nellis B. Bronner as its representative in western and central New York State.

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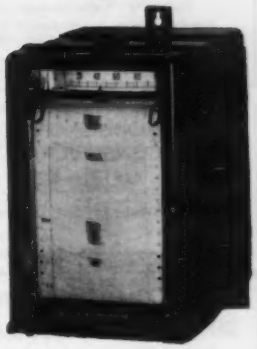

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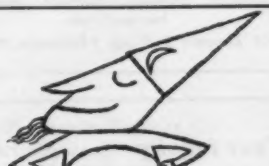

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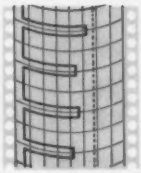

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